



1957

*conservation  
report*

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DEPARTMENT OF PLANNING AND DEVELOPMENT







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*The falls on the Napanee River at Yarker. The river has been a source of power for more than a century; it was the route over which thousands of feet of timber were driven to the mills and in places still retains much of its scenic beauty.*

Gov. Doc  
Ont  
P

Ontario. Planning and Development,  
Department of

DEPARTMENT OF PLANNING AND DEVELOPMENT

HON. W. M. NICKLE, Q.C.  
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A. H. RICHARDSON  
Chief Conservation Engineer

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NAPANEE  
VALLEY  
CONSERVATION  
REPORT  
1957



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1957



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Number 74



Honourable W. M. Nickle, Minister,  
Department of Planning and Development,  
Parliament Buildings,  
Toronto, Ontario.

Honourable Sir:

I take pleasure in transmitting  
herewith the complete Conservation Report for the  
Napane Valley.

The report covers History, Land,  
Forestry, Water and Wildlife.

Yours very truly,

A. H. Richardson.  
Chief Conservation Engineer

Toronto, September 26, 1957.



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## INTRODUCTION

Conservation has long been a subject of concern to the people of Ontario. This concern had to do originally with the protection of forests because of their importance as a source of revenue to the Province; but allied with this was the problem of wildlife management and the protection of source areas of rivers and streams. In Southern Ontario interest in conservation was indicated first by reforestation and woodlot management, but more recently this has broadened out to include flood and pollution control, improved land use and provision for recreation facilities.

While the progress in these activities has been steady up to the present, most of the programs heretofore were initiated by government departments. Recently, however, there has been a growing conception of personal obligation, especially where land use problems, farm ponds and small reforestation projects are concerned. On the other hand, control of flooding, summer flow and pollution; large reforestation projects; and recreation areas have come to be considered the responsibility of the community - the community in this case being the river valley.

With the advent of this new concept of personal and community responsibility in conservation, the Authorities movement was born, and the willingness of our people to undertake conservation in this way is indicated by the fact that in the last eleven years 18 Authorities have been established, with a total membership of 287 municipalities and an area of 12,869 square miles.

The first step in establishing a Conservation Authority is undertaken by all the municipalities wholly or partly within a watershed. Two such municipalities must first by resolution petition the Government to call a meeting for the purpose of ascertaining whether or not an Authority should be established. Two-thirds of the number of representatives



which the municipalities are entitled to appoint (on a population basis) must be present to make the meeting legal. If two-thirds of those present vote in favour of establishing an Authority a resolution is forwarded to the Government. The Authority is then established by Order-in-Council and under the Act becomes a body corporate, including representatives from all the municipalities in the watershed.

While some Authorities were brought into being because of flooding within their areas, all were aware of the necessity of carrying out such supplementary measures as improved methods of land use, reforestation, proper woodlot management, prevention of pollution, investigation of underground water supplies, wildlife studies and recreation. But the Authorities were not equipped to carry out the extensive investigations that would indicate where such work should be done. Consequently the Conservation Branch of the Department of Planning and Development undertook to carry out the preliminary investigations as a service to the Authorities, to appraise, by means of surveys and reports, the conservation needs of each watershed, and to submit to the Authority a detailed report outlining the conservation measures that should be implemented.

The survey work is grouped under five general headings, namely, Land Use, Forestry, Water, Wildlife and Recreation. The scope of the studies made in each of these subjects varies with the condition and needs of the area under investigation. In addition to the five topics indicated above, a study of the history of the area is made. This serves as a backdrop to all the conservation problems of the watershed and compels the reader to understand the abuses of the past and the need for a diversified program in the future.

The starting point for all surveys is aerial photography. Before the survey is commenced in the field all



such contributing data as maps, old records, photographs, unpublished reports and other useful information are thoroughly explored and recorded. While the survey is in progress similar data are gathered locally, and agricultural representatives, zone foresters, municipal clerks and other officials and private citizens are interviewed for additional material.

The results of these conservation surveys, together with the recommendations based upon them, are set down in the reports presented to the Authorities and intended to serve them as a blueprint. The carrying out of any scheme is not the work of the Conservation Branch of the Department of Planning and Development, because it is not an operating department. Its active participation for the most part ceases when the planning is complete and the report is submitted, although it stands by to interpret the report and give advice and assistance in carrying out the plans recommended in the report. The Authority must assume responsibility for initiating the schemes which it considers most urgent; it must also make approaches to the government departments or other bodies from which it hopes to get assistance.

If, for example, an Authority undertakes a scheme having to do with land use, it must seek assistance from the Department of Agriculture; if it involves a forestry or wildlife problem, then the Department of Lands and Forests is approached. In the case of flood control, however, as there is no department of the Government doing hydraulic surveys except the Conservation Branch, whose staff is not large enough to carry through the engineering works of several Authorities, the Authority must engage a consulting engineer to do the final engineering and designing and to carry the work through the construction stage. Similarly, where an Authority undertakes a scheme which has to do with recreation, it may have to employ men specially trained in this work.



As the work being done by Authorities is a new approach to the conservation problem, in that the responsibility of carrying it out is left entirely in the hands of the Authority concerned, much directing and assistance have been necessary from the Conservation Branch and, in the case of 13 Authorities including the Napanee, a member of the staff of the Department of Planning and Development has been assigned to work in the watershed.

The Napanee Valley Conservation Authority was established by Order-in-Council on November 20, 1947, following an organization meeting which was held at Napanee on October 23, 1947, when 10 representatives out of a total of 12 attended the meeting and 7 voted in favour of establishing the Authority.

As mentioned above, the Department of Planning and Development, as a service to an Authority, undertakes to carry out a conservation survey of the valley for the guidance of the Authority, but the commencement of conservation work in the valley does not necessarily have to wait until such a survey has been made and the report presented. This has been the case with the Napanee Valley Conservation Authority, where the Napanee Authority Forest embracing 4,379 acres has been established and the Second Depot Lake Dam set up as a scheme of the Authority.

- A. H. Richardson



# RECOMMENDATIONS



RECOMMENDATIONS  
STATED OR IMPLIED IN THIS REPORT

History

1. That, before carrying out any project, the Authority ascertain from the Royal Ontario Museum of Archaeology at Toronto, or from the appropriate department of Queen's University at Kingston, whether the area concerned is likely to contain archaeological material, and, if necessary, arrange for the investigation of the site before operations make this difficult or impossible.
2. That where records, buildings and objects exist of sufficient interest as illustrating the life of the watershed during the period of development, the preservation of these relics be considered an aspect of conservation; and that where such records and other relics are the private property of individuals and corporations within the watershed, the Authority take definite measures to encourage their preservation by their owners, or by their commitment to proper care in libraries, museums, archives, and other suitable repositories.
3. That when sites, buildings, or ruins of structures, of this kind, form part of, or are adjacent to, properties acquired by the Authority for flood control, reforestation, or recreation, the possibility of including them in the scheme be considered.
4. That in such cases sites be marked, ruins preserved, and buildings restored and used for some purpose in connection with the project compatible with retaining their original character.



5. That the Authority appoint a Historical Sites Advisory Board to make recommendations to it with regard to matters of historical interest, including the preservation of historical buildings and relics.
6. That from the large number of sites and buildings of historic interest (in the wider sense used in these recommendations) to be found within the watershed, a few be selected for inclusion in the scope of the activities of the Authority, besides those connected with recommended projects.
7. That this selection include the sites of the mills known to have been in operation before 1840, as well as the sites of early schools, churches, and other buildings of historical interest that have been destroyed, and some existing buildings interesting for their associations or age.
8. That a survey be carried out, so far as possible in co-operation with other organizations and individuals engaged in the study of local history, to ascertain what objects of historical interest exist in the watershed, and to consider how some of these may be preserved.
9. That, wherever possible, the buildings be left on their original sites and continued in their original use, or adapted to some suitable purpose in connection with the normal life of the community.
10. That the Authority provide as part of its recreation program an area or areas where buildings which it is desired to preserve may be re-erected when they cannot be retained on the original site.



### Land Use

11. That the Authority consider establishing one or more pasture farms, particularly on the limestone plains, to ascertain the costs of brush removal and the cultural practices best suited to this kind of country. p. 42
12. That the Authority promote the ideals and ideas of conservation farming through a program of publicity and public education. p. 30
13. That the Authority arrange technical and direct aid, as seems desirable, in the construction of special conservation measures. p. 45
14. That the Authority explore fully the possibilities of developing part of the Cameron Bog for intensive agricultural use. p. 57

### Forestry

15. That the Authority, under agreements with co-operators or through lease or purchase of suitable woodlots, undertake the development of Woodlot Improvement Projects to demonstrate the advantages of better forestry practice. p. 28
16. That the Napanee Authority Forest be expanded through a definite program of annual additions and planting until the total recommended area of 82,750 acres is acquired and reforested. p. 42
17. That the Authority encourage private reforestation by purchasing a tree-planter and providing a planting service at nominal cost on land suitable for machine planting, and by offering a planting subsidy where hand planting is necessary. p. 31



18. That the Authority, by purchase of equipment, organization of cutting crews, or direct subsidy, encourage private owners in thinnings and improvement cuttings in their woodlots. p. 35
- 19.(a) That the Authority investigate the Halton County fencing scheme, and adopt such a modified scheme as seems most likely to result in elimination of woodland grazing. p. 49
- (b) That the Authority publish a simple, attractive bulletin on the disadvantages of woodlot grazing.
20. That the Authority co-operate with schools, government departments, and all other groups and agencies possible to publicize the need and the methods of reforestation and woodlot management; and in particular that the Authority sponsor tours, practical demonstrations and field days for this purpose.
21. That the Authority act as co-sponsor for:
  - (a) 4-H Forestry Clubs p. 40
  - (b) The Tree Farm movement p. 40
22. That the Authority assist in investigating and publicizing markets and marketing methods for woodlot products to encourage:
  - (a) maximum use of low-grade materials from thinnings and improvement cuttings
  - (b) closer and more uniform appraisal of timber, whether standing or in the log
  - (c) marking of trees for removal
  - (d) securing of competitive bids for timber
  - (e) insistence on a written Timber Sales Contract
23. That the Authority investigate and urge the implementation of the best method of providing fire protection for wooded areas within the watershed in co-operation with the Department of Lands and Forests. p. 50



24. That the Authority encourage the establishment of windbreaks, shelterbelts and snowfences. p. 72

#### Water

25. That the Authority proceed to purchase the dam and reservoir sites of the Third, Fourth and Fifth Depot Lakes when they have received the contour plans of same showing the township lots affected.
26. That the reservoir sites be developed at least to their average annual filling capacity.
27. That when the contour plans of Third, Fourth and Fifth Depot Lake reservoirs are completed, a decision be made as to the next dam to be built and that it be constructed as soon as funds are available in order to supplement the sustained flow required at the town of Napanee.

#### Wildlife

28. It is recommended that the introduction of fish into the watershed be restricted to those parts of the river which have been shown by the survey to be suitable for the species concerned. This recommendation, of course, does not apply to those sections of the river which were not examined during the survey.
29. It is recommended that the Authority urge that the provisions of The Ontario Water Resources Commission Act, 1957, and in the Government of Canada Fisheries Act, R.S. 1952, Chapter 119, Section 33, concerning the prevention of dumping of sawdust and other wastes into rivers, be applied in those cases known on the Napanee River.
30. It is recommended that the Authority devise ways and means to attempt an introduction of the Hungarian Partridge into the farming land of the watershed.



31. It is recommended that the Authority urge that regular tests of the oxygen content and the phenol content of the Napanee River below Strathcona be carried out both before and after the construction of the Second Depot Lake Dam.



# HISTORY



## CHAPTER 1

### THE INDIANS AND THE FRENCH

On the 17th day of August, in the year 1615, the intrepid explorer, Samuel de Champlain, arrived at Cahiagué, near the present town of Orillia, and prepared to assist his friends the Hurons in their wars against their traditional enemies, the Iroquois. Two weeks later, on the first of September, the Huron war party set out, by way of Lakes Couchiching and Simcoe, made a long portage to the lakes of the Trent River system, and descended that river to the waters of the Bay of Quinte, where they spent several days hunting, and proceeded "by short days' journeys" eastward toward the lower end of Lake Ontario. In the course of this expedition, Champlain passed the mouth of the Napanee River, possibly stood on its banks, and was thus the first white man to visit the area that today, more than three hundred years later, is referred to as the Napanee Watershed.

The expedition crossed Lake Ontario, and entered the country of the Oneidas. "We continued our course by land for about twenty-five or thirty leagues. In the space of four days we crossed many brooks, and a river which proceeds from a lake that discharges into that of the Entouhonorons."\* From the 9th of October until the 16th, the Hurons, aided by Champlain and the terrifying magic of his arquebus, laid siege to a fortified Oneida village; but in the end their attacks were unsuccessful. Champlain received two arrow wounds, "one in the leg, the other in the knee, which caused me great inconvenience, aside from the severe pain". Many of the Hurons also had been wounded, and the war party, carrying Champlain trussed up in a basket, set out to retreat.

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\* The Oneida River, flowing from Oneida Lake into Lake Ontario (the "lake of the Entouhonorons"). W. L. Grant, "Voyages of Samuel de Champlain", New York, 1952, page 290.



It was toward the end of October, and much snow had fallen, when the Hurons regained the north shore of Lake Ontario, and disposed themselves for a month of hunting while they waited for the swamps and lakes to be frozen firmly enough to enable them to complete their journey to their home territory. Thus, in the month of November, 1615, Champlain was once again in the vicinity of the Napanee River and the Bay of Quinte, his wounds sufficiently healed to permit him to join the hunt, and, on at least one occasion, to wander off by himself and get lost. His account of the country in which this misadventure took place seems to indicate that it was between the Napanee and the Salmon Rivers, in the present township of Sheffield.\*

From the little that Champlain tells us of the Bay of Quinte, it is evident that its sheltered waters were a part of the regular travelled route along the north shore of Lake Ontario. The portage over the isthmus at the head of the bay must have been in constant use, and there are indications that there had been more or less permanent settlements there and at the mouth of the Napanee River, before the rise of the Iroquois Confederation. By the time of Champlain's visit, in 1615, this whole country-side was disputed territory, unsafe for permanent occupation by any Indian tribe. Champlain mentions no encounter with any other Indians than those of his own party, and shows no villages in the neighbourhood on his map of 1632.

In May 1616, Champlain returned to Quebec. He left behind him in the west a situation tense with the rancour of smouldering rivalry that was thirty years later to break out into a savage war of extermination. Since the Iroquois had destroyed the beaver and reduced the game in their old territories, their hunting and fishing grounds on Lake Ontario had

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\* W. S. Herrington, "Where Champlain lost his way".  
Archaeological Report, 1923.



become of vital importance, and it was now essential to secure the north shore from the Northern Tribes and also from the French, firmly established in Montreal. By the middle of the seventeenth century, the Iroquois had devastated the country of the Hurons and their allies, and had driven their wretched remnants across Georgian Bay to the country about Lake Superior. On the maps of the ensuing century the former Huron country is designated merely "the beaver hunting grounds of the Iroquois".

When traders from the French post at Montreal began once more to explore the shores of Lake Ontario they found scattered Iroquois villages of the fortified type, known to the French as "bourgs", and to the English as "castles". The names of two of the larger "castles", Kente and Ganneious in the Quinte region are well known. Kente, from which the Bay takes its name, is marked on French maps from 1670 on, always near the portage across the isthmus; it was the site of a Sulpician Mission in 1669, and later of a Government trading post. Ganneious was on the Napanee River, but its exact site varies on the different maps. It is generally supposed to have been near the site of the present town of Napanee.

The Iroquois castles were destroyed by Denonville in 1687, and Ganneious was particularly roughly treated. The vengeance of the Iroquois for this raid drove the French from Lake Ontario. Even Fort Frontenac was temporarily abandoned. Frontenac was able to restore French prestige to a great extent during his second term as Governor, and rebuilt Fort Frontenac. Kente, however, seems to have been left unoccupied for some years. The Senecas, Cayugas, and Oneidas did not attempt to restore their villages on the north shore, and by 1700 this region was beginning to be occupied by tribes of Ottawas, particularly the Mississaugas. These Indians were in a less advanced state of civilization than the Iroquois, often moving their villages from one site to another. They made use of the flats for cornfields, however, and in consequence often settled on or near the sites of earlier villages. In 1720 the Sieurs



Dagneau-Douville built permanent trading posts both at Kente and the Humber to secure the trade with the Mississaugas. The post at Quinte does not appear to have been given up in 1728 when that at Toronto was closed, and trading continued there throughout the French regime.

The post was now, however, of second-rate importance since the region immediately behind was no longer very productive of fur. The Mississauga settlements were scattered along the shores of the Bay, and their hunters drew their supply of fur from distant hunting grounds and even the Trent route grew less frequented as the eighteenth century progressed. It is for this reason that there are few references to British traders in the Quinte region between 1759 and the beginning of the Loyalist settlements, although the Carrying Place maintained its importance. In 1784, when Captain Robertson was asked by the Government to report on the various routes to the Upper Great Lakes from Montreal, he could only find one person at Mackinac who had "set out from the Bay of Kente, and that so far back as the year 1761."

It was in 1784 that the first "Loyalists" came to the Bay of Quinte region. These were a band of Mohawk Indians under John Deserontyou, the cousin of Joseph Brant; they were granted a large tract between the townships of Richmond and Thurlow. It was known as the Mohawk Tract until the Indians sold the northern part of their lands and the township of Tyendinaga was set up in 1820.

It is probable that the Mississaugas were already few in the Quinte area. They had sold the land from the Gananoque to the Trent in 1783. Nevertheless the Government continued to reserve Lot 4, Concession I, of Thurlow for these Indians, and refused to grant it to white settlers or to allow them to obtain leases from the Mississaugas until 1816.



## CHAPTER 2

### THE LOYALISTS, 1784-1790

But for the outbreak of the Revolution in the old Colonies, all of Canada beyond the Ottawa might have long been left to the traders and Indians. The war brought increased activity along the route from Niagara to Montreal. The established garrisons became military bases for operations to the south and some new posts were set up. There may have been a detachment on the Bay of Quinte for a time, but the main post at the lower end of the lake was on Carleton Island. The upper forts and posts came to be garrisoned chiefly by the regiments recruited from the loyal inhabitants of the colonies, and usually referred to by the authorities as the "provincial" regiments. The task of guarding the Ontario posts fell principally on the corps formed in Canada by refugees from the "back parts" of the Province of New York.

The first units of these corps consisted of colonists whose constant opposition to the revolutionary party had made them so "obnoxious" that they had been forced to leave their homes at the beginning of the troubles. They were continually being joined by others as the persecution became more widespread and intolerable. A large number of Loyalists joined Burgoyne's forces in 1777 and were permitted to go to Canada by the terms of the surrender at Saratoga. Every withdrawal of British troops from occupied territory produced a new crop of refugees, and recruiting for Loyalist regiments was constantly going on even in areas under Revolutionary control. Prominent Loyalists were given commissions in these corps and permitted to make trips into enemy territory for the purpose of recruiting their companies, gathering intelligence and encouraging whatever underground resistance was possible. The families of the recruits were sooner or later subjected to persecution, frequently





*View in the Village of Nappanee.*

Pen-and-ink sketches by Thomas Burrowes  
about 1830



*Grist Mill, Saw Mills, &c. on the Nappanee River, at Nappanee Village.*



imprisoned and forced eventually to take refuge within the British lines. By 1780 thousands of "displaced persons" of both sexes were living in Canada and receiving subsistence from the Government.

The idea that many of these people would be unable or unwilling to return to their homes at the end of the war was forced upon the authorities while the issue was still doubtful. A few of the more fortunate had already acquired property in what is now the Province of Quebec, but most still hoped to be able to return to the States and recover their possessions. Those who had taken up arms for the Crown had had their real estate confiscated. Even those who had remained quietly at home had their goods sold at "public vendue," if they refused to pay forced contributions to the Revolutionary war-chest or to take the oaths of neutrality. Almost all were dependent on government support in the form of military pay, pensions, or rations, and would eventually have heavy claims for compensation, which the British government was anxious to recognize as generously as possible. The most obvious way to provide for those who were not on active service was to grant them land on which they could support their families.

A beginning, intended to be temporary, had been made at Niagara as early as 1778. A number of Loyalists had been granted lands near the fort, partly as a means of providing the garrison with fresh food. By 1780 Governor Haldimand, who had been active in protecting the interests of the refugees, had plans under way for dividing the lake region from the Ottawa to the St. Clair into a number of districts, each subdivided into "seignories"\* in which Loyalists could be settled.

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\* The Loyalists disliked the term "seignories" as suggestive of the French feudal tenure which they refused to accept. They called the "seignories" townships or "towns" from the first.



Little could be done to carry out this plan while the war continued, but the surrender of Cornwallis increased the need for immediate action. The various provincial corps were anxious for early demobilization, and it was obvious that the number of Loyalists in Canada would soon be increased, both from the newly formed States and from Nova Scotia.

As soon as the provisional agreement was signed in 1783, Governor Haldimand took steps to carry out the plans for the settlements along the St. Lawrence River and on Lake Ontario. Since Carleton Island seemed likely to be within the territory of the new United States, it was decided to rebuild Old Fort Frontenac, and to found a town beside it, to be called Cataraqui, to serve as the base for the settlement designed to secure the eastern end of the lake. The task of exploring the lands along the St. Lawrence River and the Bay of Quinte, and to report concerning their suitability for settlement, was entrusted to Captain Justus Sherwood, who, on September 19th, 1783,

"Left Mountreal with Lt. Johns & two men of the Kings Rangers, Ensign Bottum and 7 men of the Loyal Rangers proceeded up the river St. Lawrence in a Boat."

Sherwood was impressed by the "soil black and deep, mixed with Clay and Loam", that he found in the vicinity of the Long Sault Rapids, west of the present town of Cornwall, and adopted it as a standard in evaluating the conditions he met with elsewhere. As he worked his way westward, his plan of exploration was to set a party ashore with instructions to "go by Land 3 miles back from the river, & to proceed 10 miles up the river and there wait for the Boat"; while he himself viewed the river front from one meeting place to the next. By September 27th he had reached "Oswagacha" (Oswegatchie, now Ogdensburg); on the 28th,



"Proceeded 5 Leagues the Land in this distance is not so good as above described, it being somewhat stoney, but the Soil is deep and rich and may be cultivated to great advantage, on the whole the Land may be said to be of the very best Quallity from the Lake St. Francois All the way up the River 12 miles above Oswaygacha and would admit of at least 12 Townships on the River, each 6 miles square but the six lower Townships would be the best of the twelve, indeed I think there cannot be better Land in America.

"29th. I sent 3 men with 6 days provision to go by Land from two Leagues above Oswagacha to Catarockin (Catarauqui, now Kingston)."

A week later, October 6th,

"the party who came by Land from 2 Leagues above Oswagacha Join'd us at Catarockin; they report that for the first six miles of their March the Land would admit of a tollerable good Settlement that this Township will be water'd by 3 fine Creeks, on one of which is a good place for Mills about 2 miles from the Lake\* - that all the rest of their march to within 5 miles of Catarockin the Land was exceeding bad, being a constant succession of stoney Ledges and sunken Swamps altogether unfit for Cultivation, for 3 miles at least back from the Lake, that on the last 5 miles next to Catarockin the land was broken, but in many places was improvable and would admit of a scattering Settlement. This day I went with the Boat to view the Land for 3 miles West of Six Nation Bay†to be very broken and stoney for 3 miles back from the Lake, we encamp'd this night at a Bay 9 miles West from Catarockin, this we call Muddy Bay\*\*.

"7th. proceeded up the Lake, always keeping a party out by Land 2 or 3 miles distance from the water; at about 3½ miles from Muddy Bay we came to a very fine Creek which the Indians call Mittabikitaga, or Stoney Creek††, between this Bay and creek the Land is very good except a small distance on the edge of the shore, which is stoney, but in general the stones do not extend more than 200 yards from the Water - and then begins very good Land, this river has two very fine falls, the uppermost not above a quarter of a mile from the Lake; from this we proceeded to the entrance of the Bay Quinty which is about 7½ miles from Stoney Creek, the Land all the way for three miles back which is as far as we went, is extraordinary good for any kind of Cultivation, the Soil is deep and rich, the Timber is Beach, Maple, Elm, Basswood, with some Pine & White Oak."

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\* Augusta Township, at least in part.

† Collins Bay.

\*\* Parrott Bay.

†† Millhaven Creek.



After spending the ensuing week in various explorations both east and west of "Catarockin", on October 14th,

"I sent Ensn. Bottum with the Boat to land Lt. Johns on the North side the Bay Quinty at the western extremity of the late Indian purchase\* from whence he is to proceed with the 2 men one days march north then East untill he falls in with the Catarockin River, then down the River to the Garrison."

The report returned by Lieutenant Solomon Johns, covering the journey of his party during the next few days, brings the Napanee River and its banks for the first time within the scope of these explorations.

"De Mulah House, 19th Octr. 1783.

"Lieut. Johns Journey through the Wood from Bay Canteu to Cotoroqui.

"Set out from the said house† and marched N. 2 miles and struck a large River\*\* that Came from N.E. and runs to the S.W. We March up the River 2 miles, and met with a pair of Falls on the River, we Judg'd them to be about 8 feet high, from that we march'd about 4 miles and encamp'd - Good Land the Day thro'.

"20th. We continued our Course 4 miles, then we altered our course & steared East. We march'd 8 miles and incamped. One Cedar Swamp about one mile, the Rest good Land.

"21. We continued our course East and march'd about 5 miles & struck a River†† that come from the N.W. and run to the S.E. on which is a very good Falls for Mills. We Judg'd the Falls to be about 6 feet perpendicular with Rapids some way after, from that we marched 2 miles and struck

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\* This purchase was negotiated, October 9, 1783 between Captain William Redford Crawford and the chiefs of the Mississauga Indians, and included the territory from the Toniata River (Jones' Creek, in Yonge Township) to a point on the north shore of the Bay of Quinte "within eight leagues of the bottom of the Bay." Such a point would be in the present Tyendinaga Township about one mile east of the mouth of the Salmon River. A projection of the courses and distances followed by Lieutenant Johns confirms this identification of the point of beginning.

† De Mulah appears to be a corruption of the name of John Dumoulin, an Indian trader, who, in 1779, was licensed to trade at Machidache (Matchedash), and, in 1782, was licensed to trade at "Bay of Quintay". (Dominion Archives, Ottawa: Trade Licences, 1774-1790). For the location of "De Mulah House," see the previous footnote.

\*\* The Shannon, now the Salmon, River.

†† Selby Creek.



a Large River\* that Come from the N.E. and Run S.W. We march'd up the River about 1 mile in hopes to find a ford, but finding none, we maid a Raft and Crost the River, and March'd about  $1\frac{1}{2}$  mile and encamp'd, good Land the Day thro'.

"22. We continued our Course and March'd 5 miles and Come to a small Creek† that come from the N.E. and Run to the S.W. from that we march'd 4 miles and struck another Small Creek\*\*, that come from the N. and run to the South, from that we march'd about  $1\frac{1}{2}$  mile and struck another small creek†† that come from the N.E. and run to the S.W. from that we march'd  $1\frac{1}{2}$  mile and struck a small Lake\*\*\* that Lay N.E. & S.W. We marched down the Lake side to the S.W. about  $1\frac{1}{2}$  mile when a River run out the same Course†††. We followed that for  $1\frac{1}{2}$  mile and encamped. Good Land the Day thro'.

"23th. It being a Stormy Day Lay still.

"24th. We maid a Raft and Crost the Creek we Judg'd the Creek to be about 150 yards wide, we then continu'd our Course East and march'd  $4\frac{1}{2}$  Miles and Struck a River\*\*\*\* that come from the N. and Run to the S. on which there is good falls for Mills. We judged the falls to be 8 feet, from that we struck a large Cedar Swamp on about  $3\frac{1}{2}$  miles which caused us to Turn our Course more to the N.E. which course we continued about  $3\frac{1}{2}$  miles and incamp'd, the Land the Day thro' very bad being nothing but Cedar Swamps & Stoney Ridges but a number of Butifull Springs Running from the feet of the Ridges.

"25th. We continued our Course East and march'd about 4 miles and struck a small Creek†††† that come from the North and Run S. from that we march'd S. by E. 2 miles and struck the Road that leads from Cotoroqui to the Mills above.

"S. Johns  
"Lieut. K.R."\*\*\*\*\*

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\* The Napanee River, between Napanee and Strathcona.

† Probably Little Creek, in Ernestown Township.

\*\* Probably a branch of Wilton Creek, near Thorpe, in Ernestown Township.

†† Probably Wilton Creek, about one mile south of Wilton, in Ernestown Township.

\*\*\* Odessa Lake.

††† Millhaven Creek.

\*\*\*\* Collins Creek.

†††† Little Catarauqui Creek.

\*\*\*\*\*The passages quoted from the reports of Captain Sherwood and Lieutenant Johns are taken from E. A. Cruikshank: The settlement of the United Empire Loyalists on the Upper St. Lawrence and Bay of Quinte in 1784. Ontario Historical Society, Toronto, 1934.



According to his own tally, Lieutenant Johns had, in six days' travel, marched 62 miles through hitherto unexplored wilderness, and had found most of the land suitable for settlement. He had indicated four sites suitable for mills, and had provided useful, though scanty, information respecting the timber resources of the lands he had traversed. He had crossed the Napanee River near the present Mink's Bridge, and the Millhaven Creek between Odessa Lake and the village of Odessa.

There is nothing in his narrative to indicate that he had found any trace of human occupation between "De Mulah House" and the road to the Cataraqui Mills; nothing to record the course of events during the one hundred and sixty-eight years that had elapsed since Champlain had hunted, explored, and been lost and then found, in some part of the same unbroken wilderness. But Solomon Johns' explorations were part of a great scheme, which was, within a few years, to change the face of the wilderness and to open a new chapter in the history of North America.

The Government's intention to place Loyalists in the Cataraqui region was still officially secret, but it was obvious that some rumours of it would soon leak out, and there was need to hasten the preparations; the "provincial corps" were eager for their discharge and for the chance to establish new homes for their families. In the temporary camps at St. Johns, Quebec, hundreds of Loyalists were facing the discomforts of a northern winter, supported by the promise of being "located" on lands of their own as soon as spring should come. There was danger that some would become disaffected and be persuaded to turn their backs on the Government-sponsored scheme, and attempt to start squatters' settlements elsewhere.

The preparations were pushed as rapidly as possible; masons and millwrights were brought from Niagara and Montreal. Major Holland's proposals for the townships



had been forwarded in July to Major Ross, at Carleton Island, and in September Deputy Surveyor General John Collins arrived with his surveyors to run the boundaries and to lay out at least the first few concessions in each. An assembly of Mississauga Indians was called in order to conclude a treaty of purchase, and on October 9th, 1783, Captain William Redford Crawford completed the purchase of "all the lands from Toniata or Onagara River to the River in the Bay of Quinte within eight leagues of the bottom of the said Bay, including all the Islands, extending from the Lake back as far as a man can travel in a day."\* With respect to the lands between the Salmon River and the Trent, in the Bay of Quinte, Crawford stated in his report to Sir John Johnson: "The Chiefs claiming the land at the bottom of the Bay could not be got together at present. I believe their lands can be got nearly on the same terms, though this when I see them."

There was considerable delay in getting the first sawmill built and in operation. In July, 1783, Major Ross reported to the Governor, in Quebec: "There is a very advantageous place for building Mills about five Miles from this Fort (Cataragui), but nothing more can be done than to Collect & prepare Materials untill a Mill Wright arrives... ... The Iron work &c arriv'd here Yesterday."†

On the 3rd of November, 1783, Major Ross wrote again: "I was in hopes the Saw Mills would have been finish'd this fall, which the badness of the Weather has in some measure prevented."\*\* On the 13th of November, Governor Haldimand wrote to Ross: "If in the course of the Winter any thing can be done in preparing the necessary timber for Grist and Saw Mills in the most convenient parts upon the

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\* That is, from Jones Creek, in Yonge Township, eight miles above Brockville, to the mouth of the Salmon River in the Bay of Quinte, a total distance of about eighty miles.

† Cruikshank, E.A. The King's Royal Regiment of New York. Ontario Historical Society Papers & Records, XXVII: 1931. Page 295.

\*\* Ibid., page 303.



intended Settlement, it would be forwarding the General plan."\*

In a further communication, dated February 17th, 1784, Major Ross wrote:

"The winter has been uncommonly severe, and the frequent falls of snow have in some measure retarded our operations, but as the Weather now moderates and the days grow longer, Work will go on rapidly; amongst other things, one Saw Mill and preparations for another will be accomplished before the Settlers can arrive; a Grist mill is also ready to be put up as soon as the weather will permit, which together with the Saw Mill on the same stream will go on in the Severest Season."†

It was not until the 14th of June, 1784, that Ross was able to report to Governor Haldimand:

"The Saw Mill is a very good one, but an expensive job, and taken much longer time building than what Mr. Brass of the Rangers\*\* told me was necessary. I believe the man employed on the occasion to be a very good artificer himself, but perhaps has not that influence or command over the workmen which Mr. Brass is said to have, he says he only agreed to build one Saw mill and one Grist mill, wherefore I have sent for Mr. Brass (agreeable to your Excellencys directions in a former letter) and if he comes his Expeditious method in building mills will I hope, not only be a great Saving to Government, but very beneficial to the new Settlement."††

Ross' report concludes with a brief summary "of the several works that has been completed and in hand during the Winter." The following items refer to the mills on the Cataraqui River:

"Saw Mill complete  
"Grist Mill now in hand and somewhat advanced"

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\* Cruikshank, E.A. op. cit., page 304.

† Ibid., page 309.

\*\* In another letter, dated August 17, 1783, Major Ross thus refers to Mr. Brass: "There is an officer of the Rangers, at Niagara, of the name of Brass, of a remarkable genius, an exceeding good Millwright. .... When I received His Excellencys directions concerning the Mill to be built here, I took the liberty..... to apply to Coll. Butler for a visit from Lieut. Brass, but he was so much employed that he could not then be spared."

†† Cruikshank, E.A. Op. cit., page 311.



The settlers had already begun to arrive on the shores of the Bay of Quinte, and sawn lumber was in increasing demand. Before the saw mill at Cataraqui was in operation, on May 20, 1784, Governor Haldimand had written to Sir John Johnson, Superintendent for Indian Affairs,

"Mr. Collins has built a Saw Mill near to Cataraqui, I have taken it for the use of the King, & would have it immediately prepared for Work for the Public good of the Loyalists who will have the Planks & Boards necessary for their Houses gratis, this is one of the first things to be Attended to and will prove a very Advantageous circumstance."\*

In a further communication on the same subject, the Governor again refers to the purposes the saw mill was designed to serve; the letter, written by his secretary, Major Matthews, was dated June 24, 1784:

"As the chief object of the Saw Mill is for the accommodation of the Loyalists, (the Governor) leaves it to your discretion to employ it, for the present, in such manner as you shall think the most conducive to the general good of the Settlement without favor or affection to any Individual, taking a preference, of course, of whatever Boards &c., may be wanted for the use of the Crown."†

In the same letter (June 24, 1784), Major Matthews asked Major Ross to "form some judgement of the utility" of the mill on the Cataraqui, and to furnish the Governor with his opinion on that subject. Ross' reply, dated September 2, 1784, indicates that the mill on the Cataraqui was proving in some ways unsatisfactory, and that another mill, "now in hand" (whose exact location he does not specify) was "much more advantageously placed."

"Such is the Nature of the Winds in this place that they blow almost Constantly from the Lake, the Settlers therefore have found great difficulty in transporting the Boards from the Mill, and on account of Head Winds may have Cost them more before they got them to their respective Townships than if they had bought them on the ground.....

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\* Haldimand to Johnson, May 20, 1784. From Cruikshank, E.A.: The settlement of the United Empire Loyalists on the Upper St. Lawrence and Bay of Quinte in 1784. Page 105.

† Matthews to Ross, June 24, 1784: Ibid., page 127.



Wherefore the mill in question will answer the purpose of Supplying the Settlement downwards, and also all Settlers about this place, for which I hope it will turn out to Considerable Advantage."\*

Toward the end of September, Major Ross made a further reference to the second saw mill, still without identifying its location:

"..... the Weather has been very bad of late which has Somewhat hindered the progress of the Sawmill of the Bay of Quinty, and the best of the workmen would not quit their land, however it will Soon be done, that Mill is most Commodiously Situated and easily supplied with timber down the very Stream that turns it."†

A letter from Major Edward Jessup, of the Loyal Rangers, to Major Matthews, dated at Quebec, October 5, 1784, provides the clue to the location of the second saw mill:

"Please to acquaint His Excellency the Governor that the new Settlements of those formerly belonging and attached to the Loyal Rangers are much in want of Sawmills and will next summer be in great want of Corn Mills - The most Convenient places for Building Mills near Oswegatia are the Gallowes on the sixth senory & a small River or Brook in the Eight senory.

"There is also a good place in the second senory near Catraque (where part of that Corps are settled) on a small river which I think was Marked on the Map for that purpose."\*\*

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\* Ross to Matthews, Sept. 2, 1784: Ibid., pages 160-161.

† Cruikshank, E.A. The King's Royal Regiment of New York. Ontario Historical Society Papers and Records, XXVII: 1931. Page 315. Ross to Haldimand, September 29, 1784.

\*\* Cruikshank, E.A. The settlement of the United Empire Loyalists on the Upper St. Lawrence and Bay of Quinte in 1784. Ontario Historical Society, Toronto, 1934. Page 170. Jessup to Matthews, October 5, 1784. Places referred to in this letter are identified as follows:  
Oswegatia (Oswegatchie) - Ogdensburg, N.Y.  
Gallowes - the Galop, or Galops, Rapids.  
Sixth senory - Edwardsburgh Township.  
Eighth senory - Elizabethtown Township.  
Second senory near Catraque - Ernestown Township.  
Catraque (Cataragui) - Kingston.  
A small river in the second senory - Millhaven Creek, (called by Captain Sherwood, Stoney Creek).



Since the location of the second saw mill is nowhere exactly identified, it seems proper at this point to summarize the relevant indications, and to attempt from them to determine what that location may have been.

- (1) Ross (September 2, 1784): the settlers have difficulty in transporting boards from Cataragui to the westward, on account of the winds. A mill is now in hand that is more conveniently located, and from which it will be easier to supply the settlement "downwards", that is, to the eastward.
- (2) Ross (September 29, 1784): the sawmill of the Bay of Quinty has been hindered, but will soon be completed.
- (3) Jessup (October 5, 1784): a place in the second senory (Ernestown), suitable for a mill, had been marked on the map for that purpose.
- (4) Captain Sherwood (October 7, 1783): at three and a half miles west of Muddy Bay (Parrott Bay), a very fine creek, which has two falls within a quarter of a mile of its mouth.
- (5) Finally, it will presently be shown that the saw mill on the Napanee River was "raised" on March 23, 1786.

The requirements of all these indications can be met by assuming that the second mill was built on Millhaven Creek, near the present village of Millhaven. Such an assumption is further supported by two additional references. In 1791, Richard Cartwright, of Kingston, petitioned for the grant of Lot No. 18, in the first Concession of Ernestown, for the purpose of erecting a grist mill, and added "that a saw-mill was sometime since thereon erected by Government which stands idle eight months of the year for want of water; that water may be brought to it, but at an expence too heavy to be compensated by the profits from a saw-mill."\* And in 1792, the Deputy Surveyor, Alexander Aitken, reported to the Surveyor General: "Mill Creek, No. 18 1st Concession, Ernesttown. A Saw Mill is built on this Creek belonging to the Crown. Rafts of Timber may be brought up to the Mill, but has not a constant supply of Water."†

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\* Minutes of the Executive Council of the Province of Quebec, March 31, 1791.

† Survey Records, Department of Lands and Forests. Letters Received, Vol. I: page 64.



Unfortunately, the prediction of Major Ross of a supply of timber "down the very stream that turns it" proved unduly optimistic, for the Millhaven Creek has seldom, if ever, been "driven."

It thus appears that the saw mill at the Napanee was the third to be built in the Cataraqui-Bay of Quinte area. According to the account book of Robert Clark, the millwright who had built the Government mills on the Cataraqui, and was now instructed to build a mill on the Napanee River, the materials required for the construction were assembled during the winter of 1785-86. In the spring of 1786, among other items, the following appear.\*

March 23 - For Raising the Sawmill: 2 gallons and 3 pints of Rum, 17s 6d.

May 25 - To 4 gallons and 1 quart of Rum, for Raising the Grist Mill, at 7s 6d.

May 26 - To 1 quart of Rum for the people at work in the water at the Dam.

The same account book shows that the bolt cloth for the Napanee grist mill was bought in December 1786, and from this it may be inferred that the mill began operations early in 1787. The order in which these several mills were established appears accordingly to be as follows.

June 1784 - Sawmill completed at Cataraqui.  
Later, 1784 - Grist mill completed at Cataraqui.  
Spring, 1785 - Sawmill completed at Millhaven Creek.  
March 1786 - Sawmill "raised" at Napanee.  
May 1786 - Gristmill "raised" at Napanee.

Groups of settlers began to arrive at Cataraqui in the spring of 1784. Land was distributed by lot, even before the surveys were completed. With a few exceptions only one lot of 200 acres was granted to any one claimant in the first concession of a township. The

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\* Quoted in Canniff, Wm.: History of the Settlement of Upper Canada, Toronto, 1869: page 207.



townships were numbered in the order in which they were laid out. Starting from the west bank of the Cataraqui the fronts of Townships 1 to 4\* stretched to the narrows of Adolphus Reach. The surveyors then crossed to the peninsula and laid out three townships along the northern shores of what is now Prince Edward County. The eighth and ninth townships (Sidney and Thurlow) extended from the Trent to the western boundary of the Mohawk Tract at the mouth of the Salmon River and a tenth township, (Richmond), was laid out east of this tract along the right bank of the Napanee River, behind the "Third Township."

Early in 1784, the boundaries of these townships had been sufficiently fixed to allow of the lots being drawn for, but the actual survey of the concessions took time and the settlers soon became impatient. On May 7th, 1784, Major Ross reported that they were distressed because "they could not see their lands," which were not yet surveyed, but expressed the hope that they might be able to get their holdings in time to plant fall wheat. On July 5th he reports that no settlers have yet located on their lands, though some had "removed to their townships," apparently to camp there till their lots were surveyed. Meanwhile the numbers of refugees at Cataraqui were growing steadily and supplies were running short. On the seventh of July, Ross reports that he has been forced to reduce rations, to the distress and discontent of the Loyalists, and on the same day seventeen officers signed a memorial to the Governor protesting against the reduction. It was proposed to reduce the ration to two-thirds until May 1st, 1785, and to one-third until May

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\* Kingston, Ernestown, Fredericksburgh, Adolphustown. Adolphustown was at first intended to be part of No. 3, but was separated to provide a company with a township to themselves. The names were given later in honour of King George and his fifth, second, and seventh sons.



1786. The signers emphasize the hardship this will bring on their families and remark that if it is carried out "very few will stay."

"..... that thro' unavoidable delays, the Season being already too far Advanced to permit the least hope of their raising anything towards their Support until next Spring, & even then nothing of consequence - and their Remote situation, want of Communication with the Inhabited Part of Canada in the Winter Season, joined to the inability of the greater part to purchase supplies, even if within reach, justly fill them with the most gloomy apprehensions, that disorders arising from their wretched situation and very contracted Allowance of Provisions will fatally frustrate His Majesty's good intentions towards them, and Ruin a numerous Settlement in its Infancy .... Unless relieved by His Excellency's Humane Interference (they) have nothing but extreem Misery to expect."\*

Tempers were getting frayed in the refugee camps and Ross reports disputes among the Loyalists, chiefly "between master and servant." He remarks that "a strange collection of people" was assembled at Cataraqui.

The units of this "strange collection" exhibited a wide range of character and background. They varied greatly in racial origin, though Scots and "Dutch" probably predominated. Most had been born in the colonies, but natives of all the British Isles and a few Europeans were also to be found. The "Dutch" included both Hollanders from New York and some German Americans from the Mohawk and elsewhere. They had mostly been men of moderate or small means. Hardly any members of the great landed families of the middle or southern colonies came direct to Canada and only a small proportion of Upper Canada Loyalists could be said to have been rich.

The average settlers in the Quinte region however had probably lost more by their loyalty than the

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\* Cruikshank, E.A. Settlement of the United Empire Loyalists, page 131.



general statements of some recent writers would indicate.\* Since they came mostly from the inland counties of New York State, where it was difficult to obtain freehold land, they had usually been tenants on the large estates - "patents" or "patroonships." However, unlike the bulk of the Highlanders of Glengarry and the St. Lawrence townships, they were not new settlers on small bush holdings, but had bought leases "for life" or "forever" on improved farms and were practically in the position of freeholders. The ground landlord collected a small portion of the produce each year as a quit-rent, but the improvements belonged to the tenant.†

In many cases the Quinte Loyalists had paid a fairly substantial sum to the former tenant for his improvements. They had mostly taken their farms at the end of the French and Indian Wars (1760-1770), and in ten or fifteen years of peaceful occupation had increased the value of their rights in the farms to double or treble this purchase price. They had greatly increased the amount of cleared land, built houses, planted orchards, got together a good deal of stock, "utensils,\*\* and furniture. They had seemed secure of a comfortable living and some were even achieving a degree of affluence.

The Revolution had stripped them of all this and in 1785 the Quinte settlers were still dependent on the Government for everything needed to start their new life. The authorities at Quebec were doing their best to supply their needs, but difficulties of transportation aggravated the ordinary slowness of government departments and everything

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\* Reacting from the romanticism of some early writers, it was for a time the practice to represent the Upper Canada Loyalists as almost all "log-cabin" pioneers, who exchanged a recent bush farm in the States for a similar one in Canada. This was as much an exaggeration as the former attitude.

† This refers to the newer "Patents." On the older Dutch "Patroonships" the burdens on the tenant were heavier and his position was less good.

\*\* "Utensils" is used in the claims to cover farm implements and the apparatus of domestic manufactures.



was in short supply. In the opinion of the settlers, there were not enough tools, seed, or cattle.\* By the autumn of 1784 some settlers were busy planting wheat and building houses and it was becoming evident, as settlement spread up the bay, that the mills and merchants of Cataragui would be of less use to the inhabitants of the upper townships. The proposed mills at Ernestown and on the Napanee River would serve to meet the most urgent and immediate needs of the pioneers, but there were evidently openings for enterprising men with a little capital along the shores of the Bay, if any such could be found.

With the capital obtained as compensation for losses sustained during the war, John Walden Meyers, in 1789, bought one hundred acres on the Saganashkokan, now the Moira, River, and in the ensuing winter began to build a saw- and grist-mill. For five or six years his was the only grist mill between the Napanee and the Don.

The first few years in the life of the new settlements on the Bay of Quinte were years of hardship, when the main problem was how to survive, and the convenience afforded by the sawmills and grist mills was a significant factor in meeting this problem. The settlers had little to spend on luxuries. Even such staples as flour, salt, tea and gunpowder sold at prohibitory prices, and, lacking time and ammunition to hunt, the settlers had little to barter. Each new grist mill was hailed as a great boon by the families near enough to use it. At the Napanee Mills "a small toll was exacted to pay for the daily expences of the Mill - but this was a mere trifle considering the advantages the settlers saved from loss of time in proceeding to Kingston."†

In 1788 came unexpected tragedy. That summer drought set in early and continued unbroken for months. Even

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\* The allowance was one cow to every two families.

† Memoirs of Colonel John Clark. Ontario Historical Society Papers and Records, Vol. VII, pages 157-193.



allowing for exaggeration in the recollections of old people, there seems to have been no such disastrous season in the history of the Province; it surpassed even that of 1949. The issue of rations had just been discontinued and since the situation had developed slowly the Government was not prepared for the desperate straits to which the inhabitants of Upper Canada were reduced by the opening of 1789. Since all crops had failed there was hardly enough for the next year's seed. Cattle and sheep were scarce in the settlements in any case; many died, though hogs seem sometimes to have survived, and the chief source of meat was the deer. Extensive forest fires and the lack of ammunition cut off this source of food from most settlers, and an unusually cold winter sealed the lakes and rivers with such thick ice that fishing was made so difficult as to be nearly impossible. Springs, swamps and streams dried up, and when the luckless settlers were forced to take their precious seed grain to the mills there was difficulty getting it ground.

By midsummer people were eating any sort of food they could get, and some died from eating poisonous roots, some starved, and many of the old and the very young died later from the effects of under-nourishment and unsuitable food. The authorities did what they could. At Niagara and Kingston the commanders on their own responsibility put the garrisons on the shortest possible rations and issued the "King's Stores" to the worst sufferers. Supplies were shipped in from Lower Canada and free importation was allowed from the United States, rather too late to help the situation at its worst.

The settlements on the Bay of Quinte suffered even more than the rest. Here there were no "King's Storehouses" or merchants with large stocks and large resources, and the Upper Bay lay out of the way of shipping. Some merchants shamelessly exploited the situation, and men parted with everything they had to obtain a little flour or a few potatoes. Some traders grumbled but gave credit as far as



their stocks went, and sometimes ruined themselves in the process.

The "starving year" had a marked effect on the course of settlement as well as on other aspects of life in Upper Canada. With the crops of 1789 conditions became more normal. Many families, however, found themselves in debt and others had sold their land or landscrip to the merchants. Loyalists were still arriving from the States or from the lower provinces in considerable numbers, and many of these purchased improved farms from the famine sufferers or bought scrip from the merchants to obtain a good location.

Before the year 1790, the history of the Napanee valley is not distinct from the history of the Bay of Quinte as a whole. Richmond Township was surveyed in 1787 by John Collins; and the Township of Camden East was included in a proclamation dated July 24th, 1788, among the townships making up the District of Mecklenburg. The first mills at Napanee, built in 1786, were on the Fredericksburgh side of the river, where a clearing of one and three-quarter acres was made, and where a few houses were built to accommodate the mill workers; but there is no indication that anyone not connected with the mills had as yet settled in the vicinity. Only as the years went by and the "front" Townships of Ernestown, Fredericksburgh, and Adolphustown gradually became more fully settled, did the settlers push farther and farther into the remoter parts of Richmond and Camden East; and in time it was more often than not the sons of the original settlers of the "front" who set out to seek their fortune in the new country farther inland.

As settlement proceeded, the back concessions were in many ways dependent on the older communities of the "front". There were the ties of family and of neighbourliness. Through the settlements on the Bay were the lines of supply by which all sorts of provisions and "utensils" had to be



obtained. The ministrations of the Church were established first in the older townships, and only gradually extended to reach the newer settlements on and beyond the Napanee River.

The tide of settlement was not uniform in its flow, for the land was not all equally desirable. The Loyalist and American settlers were looking for land which could be brought into profitable production as quickly as possible. They had little use for heavy land if it needed any draining, and avoided swamps and swales no matter how great their potential fertility. As a rule they also rejected thin-soiled rocky land and sandy "pine barrens" or "oak plains"\*, if anything else was available. What they preferred was rolling well-drained loam, and they would put up with stoniness, lightness, and with steepness of slope, rather than with sourness or wetness.

By 1790 a Loyalist family was usually entitled to far more land than it could farm. The Government had come to realise that the original scale of grants was not so generous as it might appear to Europeans. Unimproved wild land had almost no immediate value, and poor markets, the high price of imported goods, the need for large quantities of fuel, and the primitive method of farming all combined to make a larger acreage necessary to support a family in comfort. The basic grant of fifty acres for each colonist and one hundred for heads of families was finally increased to one 200-acre lot for each adult Loyalist, while military grants were made equal to the special scale promised to the 84th Regiment of Foot on enlistment. This ran from 300 acres for a private to 5,000 acres for a field officer.

Further grants were made to justices of the peace, to merchants and professional men and their wives

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\* Oak plains, i.e., stretches of open country sparsely dotted with oak, but not necessarily flat, were objected to on account of the lack of fuel.

† This was to encourage immigration of men of means and education. The grants to J.P.'s and Members of Council, etc., were in lieu of salary increases and fees.



and children, while members of the Legislative Council received the same grant as field officers. Thus any Loyalist who could prove his military service could apply for "additional" lands and, if his first allotment had proved unsatisfactory, select a better location for the new grant. Wild land was untaxed and the poor lots were held until the "location ticket" or the land itself could be sold to some newcomer.\*

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\* Patents were issuable on completion of settlement duties, but there was much delay on both sides and the rights to land were often sold before patenting.



## CHAPTER 3

### THE GROWTH OF SETTLEMENT, 1790 - 1880

#### 1. Napanee

The earliest accounts of the Napanee River apply to it the name of Appeneea, or Apanee. This is said to be a word of the Mississauga language, but the meaning of the name is not known. Some writers have maintained that the word meant flour, and was given because of the mills that were associated with the falls in the river; but Dr. Canniff and others have shown that the name was applied to the river before the building of the mills in 1786\*, and W.S. Herrington, in his "History of the County of Lennox and Addington", refers to the name Appaneea as "the Indian appellation of the falls before the white man took up any land in the vicinity".†

Apart from Robert Clark, the millwright, there appears to be no record of the names of those who made up the little community in the mill clearing at the foot of the falls of the Napanee, in 1785 and 1786. In 1787 the Society for the Propagation of the Gospel in Foreign Parts appointed the Rev. John Langhorn to their mission in Ernestown; the missionary resided at Bath, and paid periodic visits to the various centres of settlement in Ernestown and Fredericksburgh, to each of which he gave a distinctive ecclesiastical name: Hay Bay he called St. Cuthbert's; the "Apanee River Meeting" was St. Oswald's; and "that at Mr. McLeod's Schoolhouse in Ernest Town", St. Thomas's. In 1789 he reported one communicant at St. Oswald's, in Fredericksburgh, where, in the course of the previous winter, he had preached five times. The reports of this mission supply an occasional glimpse of the development of the community that grew up about the mills.

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\* Canniff, William. History of the Settlement of Upper Canada, Toronto, 1869, page 209.

† Page 208.





The Residence of JAMES NIMMO Esq.  
CAMDEN C.W.



The Hinch House, 1828  
near Camden East



- 1789 - There are Meetings at private houses, where he officiates.  
1790 - Last winter, thrice at St. Oswald's.  
1791 - Last winter, 5 times at St. Oswald's.  
1792 - He began two new places of worship last winter, so that he has now no less than 8 in the whole Parish . . . St. Luke is part of what he heretofore called St. Oswald's, Fredericksburg, and lies by the Mohawk Bay. During the winter he was 5 times at St. Oswald's, once at St. Luke's.  
1793 - 5 times at St. Luke's, 5 times at St. Oswald's.  
1795 - 5 times at St. Luke's, 5 times at St. Oswald's.  
1797 - 4 times at St. Luke's, 4 at St. Oswald's.  
1804 - He has preached also on week-days . . . 4 times at St. Oswald's.  
1807 - Once at the Apanee River.  
1808 - (In the last half-year) he has preached twice at the Apponee, or St. Oswald's as he sometimes calls it.  
1809 - He performs Divine Service on Sundays at three different places in Fredericksburgh, at which the Bigbrook people are offended. The Napponee Mills, a Tract he had been accustomed to call St. Oswald, is one of the places where he does duty on a Sunday, the people of which apprehending that the place they assemble in will prove too little, if it be a fine day, want to have the Service on the north-west side of the river, which is out of his bounds. He has however agreed to go over, and perform the forenoon service there, provided he may return to the afternoon service on his own side of the river. The Napponee people then became desirous to perform the service themselves on Sundays in his absence, and wanted him to lend them his manuscript sermons. This he would not agree to; but offered to lend them for a time an excellent printed book. He does not know what resolution they have come to.\*

It is apparent from the 1809 report that the increase of population on the north-west side of the river was by that time beginning to outweigh the numbers living on the Fredericksburgh bank, and that only Mr. Langhorn's strong sense of his obligation to keep within the bounds of his "Parish" (Ernestown and Fredericksburgh Townships) prevented him from holding his Sunday services in Richmond Township. Langhorn resigned and returned to England in 1813. As late as 1820, his successor, the Rev. John Stoughton, "Missionary at Bath", reported "that he has hitherto officiated once a

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\* Young, A.H. The Rev. John Langhorn, Church of England Missionary at Fredericksburg and Ernesttown, 1787-1813. Ontario Historical Society Papers and Records, XXIII: 523-564



month at the Napanee Mills, distant fourteen miles, but he proposes hereafter to confine himself to his own District and Fredericksburg".\* Not until 1831 did the people of Napanee have a clergyman appointed to minister to them, and even then his duties at Napanee were secondary to his services among the Mohawks in Tyendinaga.

"There is a candidate for orders in this place York, later Toronto, Mr. Saltern Givins - son of Col. Givins, Superintendent in the Indian Department - whom I am so well pleased with and think so fit for the Mohawk station, that I beg to recommend him to the Venerable Society for appointment to that mission. Indeed, under the circumstances of the case - the strong claims of the Mohawks to have the benefit of the services of a missionary without delay, and the apparent disposition of the Society to meet their wishes - it is my intention to ordain Mr. Givins to the mission in the month of April, when he will be twenty-three years of age. This nomination will, of course, be subject to the approbation of the Board. Mr. Givins was, for some time, employed as a clerk in the government office here, but he relinquished that appointment and other prospects of promotion for the sake of devoting himself to the service of the Church. In the meantime, the Rev. T. Campbell continues to make occasional visits to the Mohawk Church. There will be one congregation at least in the neighbourhood, particularly at the village of Napanee, where the Messrs. Cartwright purpose, with the assistance of the people, soon to build a church, and where the services of the missionary will be very useful to the white people."†

The good purposes of the Messrs. Cartwright, of Kingston, "with the assistance of the people", were carried into effect in the course of the ensuing four years. In January, 1835, the Rev. Stewart Harpur was appointed as a Travelling Missionary in the Bay of Quinte area; and in June of that year, Mr. Harpur recorded in his Journal:

"On Saturday, June the 20th, I proceeded from Kingston per steam boat, to the Mohawk Mission, and the next day (June 21st) preached for Mr. Givins in the morning at the Indian Church, and in the evening at the Napanee village, where

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\* Society for the Propagation of the Gospel in Foreign Part Annual Report, 1820: 107.

† Society for the Propagation of the Gospel in Foreign Part Annual Report, 1831: 100. The writer was the Bishop of Quebec.





## ROADS, MILLS, CHURCHES, ETC.- 1836

BASED ON A MAP BY  
PUBLIUS VERGIUS ELMORE, D.P.S.



a numerous and most interesting congregation has been formed by the exertions of Mr. G., and a new neat stone church, now near its completion, has been erected by J.S. Cartwright, of Kingston."\*

A further five years passed before the new church was consecrated. The Rt. Rev. John Strachan, first Bishop of Toronto, made a tour of visitation through the eastern part of his diocese in 1840, in the course of which, on July 18th, he visited the Mohawks, and then

"we drove to the Napanee village, nine miles; but it was so intensely hot, that we were a little beyond our time. The church is a neat stone building, erected principally at the expense of the Rev. Robert D. Cartwright, and his brother, John S. Cartwright, Esquire, both of Kingston, and large proprietors in this neighbourhood. The service was rather long, as the church had to be consecrated. The congregation is at present under the care of Mr. Givins, the Indian Missionary, who has service every Sunday. . . . After drinking tea with Allan McPherson Esquire, one of the principal inhabitants of the village, we began, though late, our journey to Bath, twelve miles, and arrived at the rectory very late, where we were cordially welcomed by the Rev. A.F. Atkinson, the worthy clergyman of the parish."†

In the meantime, the community on the Fredericksburgh side of the river was developing in a way that seriously rivalled the growth of the village in Richmond Township. From the original clearing beside the mills, the houses of the employees spread upstream to the top of the falls; then as they needed room for further expansion, they leaped across an unsuitable strip of shallow soil to the more attractive locality above the bend in the river, where a busy village grew up, and where, in 1834, the Deputy Surveyor, F.P. Rubidge, laid out the town plot of Clarkville, taking its name from Sergeant-Major James Clark, Government manager of the

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\* Waddilove, Rev. W.J.D. The Stewart Missions. London, 1838. Page 111.

† Society for the Propagation of the Gospel in Foreign Parts, Annual Report, 1841: page xcvi.



Napanee Mills, and owner of the land on which the village was built.\*

"Roblin's Hill was not considered suitable for dwellings, owing to the shallow soil, the supposed difficulty in obtaining drinking water, and the steep climb that was necessary in order to gain the summit; yet Mr. David Roblin, in his day the most influential man in the county, chose it as a site for his house. Clarkville was limited to a narrow strip along the base of the hill; but Mr. Archie McNeil, a shrewd and calculating business man, had such confidence in its ultimate destiny that he built a store there, and erected a substantial house, surrounded by beautiful grounds decorated with shrubbery and flowers."†

As Napanee and Clarkville continued to grow, a keen spirit of rivalry grew up between them. Each had its own tavern, each built its own school; in each a store was built. The south side of the river had the prestige of possessing the first mill, and for a time claimed among its residents the only doctor. The Township of Fredericksburgh had been among the first settlements on the Bay of Quinte, while Richmond had remained for several years in the backwoods and the wilderness. It hurt the pride of the good people of Clarkville to think of sending their children to Napanee to school; it gratified them to see the neighbours from Richmond flock across the river to Fredericksburgh to church. But the request of the

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\* Not to be confused with Robert Clark, the millwright. Robert Clark was born in 1744, in Dutchess County, New York; built the Cataraqui Mills in 1784; moved in 1785 to Lot 34, First Concession of Ernestown; in 1786 built the Napanee Mills; and "commenced work for Mr. Cartwright at the Napanee Mills, the 28th August, 1792". He had a son, John C. Clark.

Sergeant-Major James Clark was born in Somersetshire, England, in 1737; came to Quebec with the 8th King's Own Regiment in 1768; in 1776 he was appointed Clerk and Naval Storekeeper at Carleton Island; in 1786 he removed to Fredericksburgh, and was appointed to take charge of the Napanee Mills; in 1789 he was appointed Barrack-master at Fort Niagara, a post which he held until his death in 1810; from 1800 to 1803 he also held the post of Sheriff of the Niagara District. One of his sons was Col. John Clark, writer of the "Memoirs"; another was James Clark, Junior, who was, for some years, Clerk of the Legislative Council.

† Herrington, W.S. History of the County of Lennox and Addington. Toronto, 1913. Page 209.



people of Napanee, in 1809, for a church service of their own reflected changes in the relations of the two communities that could be neither ignored nor resisted. Napanee was increasing in importance; Clarkville was dwindling - and the trend could not be reversed.

Homes, stores, schools, and churches, all increased faster on the north bank than on the south. Allan Macpherson, the "King of Napanee", at first a resident of Clarkville, crossed the river to build on the north bank "the handsomest house in the county at the time of its erection". By 1846, a canal, cut through the solid limestone, had been built to supply water to the mills that were growing up on the Richmond side of the falls, and the "estate of the late John S. Cartwright, M.P.P." had built the Napanee Flouring Mills, "using an overshot wheel, twenty-six feet in diameter, twelve feet in breadth".

"The building is partly of stone, and part of wood, seven stories in height, and contains large store-rooms, and four run of stones. One thousand bushels of wheat can be manufactured into flour, at this mill, every twenty-four hours."\*

In 1846, the population of Napanee was given as "about 500", including two physicians, two lawyers, two saddlers, three blacksmiths, two waggon makers, six tailors, two druggists, one painter, one cabinet maker, one hatter, one tinsmith, two bakers, one watchmaker, one cooper, and one chairmaker.† From this time on, the distinction between Napanee and Clarkville disappears, the former name being applied to the whole community.

An influence that restricted the growth of the town on the north bank of the river was the existence of a wide swamp just west of East Street. According to Herrington,

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\* Mitchell's Directory of Kingston, and the counties of Frontenac, and Lennox and Addington. Toronto, 1865. Page 154.

† Smith, Wm. H. Canadian Gazetteer. Toronto, 1846. Page 120. It is possible that this enumeration included both sides of the river.



"it was not until about the year 1840 that there was any serious thought of extending the limit of the corporation west of East Street and then only when, by a process of elimination, expansion in every other direction was considered out of the question. . . . Piety Hill was separated from West Bridge Street by a low, wet ravine, and the high ground in the west end of the town was covered with pine trees, a few of which, having escaped the axe of the woodman, are still standing . . . That part of the town just west of Robert Street, which contains so many handsome dwellings, was almost inaccessible, and could be reached only by crossing a creek beyond which was a swamp in which the water was several feet deep even in the time of some of the present inhabitants".\*

The town continued to grow. In time the swamp was filled, and the creek was carried through underground conduits. Residences, churches, and schools followed the westward trend of expansion, while the business section of the town, at first confined to the East Ward, pushed gradually westward along Main and Dundas Streets. In 1913, Herrington appeared to think it had reached its final limit at Centre Street.

"Year after year witnessed the erection of more stores along Main Street until Centre Street was reached; and about the middle of the last century Campbell's corner opposite the Campbell house came into favour with the country folk and received a very large share of their patronage. Beyond this point on Main Street all efforts to establish a profitable business house of any kind have, with very few exceptions, invariably failed."†

In 1957, the business section on Dundas Street ends at Robert Street, one block farther west than Centre Street. All this growth to the westward increased the difficulty of operating a successful business in the older East Ward, and completed the doom of the still more ancient Clarkville across the river.

Napanee was made a police village in 1852, and in 1855 became an incorporated village. In 1855, it was

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\* Herrington, W.S. Op. cit., page 211.

† Ibid., page 224. Main Street leads into Dundas Street at their intersection with Adelphi Street, so that the expansion noted by Herrington is actually along Dundas Street, rather than "along Main Street", for the three blocks from Adelphi Street to Centre Street.



decided at a public meeting to build a town-hall and to purchase a fire engine; both resolves were carried into effect in the course of the following year. On the 21st of August, 1863, while still enjoying the status of a village, Napanee was proclaimed the county town of the newly formed county of Lennox and Addington. Accordingly, on the 30th of June, 1864, "an Act of the Legislative Council and Assembly of Canada received the royal assent, whereby the village became an incorporated town from December 1st of the same year". At the first meeting of the County Council, in 1863, the sum of \$20,000 was voted for the building of a court house, and this building was begun in 1864.

From time to time the more ambitious citizens of Napanee have proposed for their home town the prospect of its further advancement to the status of a city. The following is from the pen of an anonymous writer in 1861:

"Take your stand on Roblin's Height and look down upon Napanee, and even though you hail from the would-be ambitious Newburgh, you will be forced to admit that its appearance is really imposing. On its south-eastern side the waters of the Napanee River, having cleared the rapids, flow softly around a semicircular bend evidently intended by nature for the site of a large city."\*

A few years later, an equally ardent admirer appears to have been even more certain of Napanee's glorious destiny when he wrote:

"The business places, including stores of all kinds, hotels and other accommodations, together with its town hall, extensive market, attractive exhibition building, banking and insurance offices, with many other structures, will do justice to the heads and hearts of the people, when in the near future the town of Napanee will become the dignified city."†

By 1878, Napanee was

"an incorporated town of considerable importance, which stands on the margin of the Napanee River, and is located in the townships of Richmond and Fredericksburgh. It is the county seat of Lennox

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\* Herrington, W.S. Op. cit., pages 241-242.

† Historical Atlas of Frontenac, Lennox and Addington. J.H. Meacham & Co., 1878. Page 14.



Moscow  
1948



Newburgh  
1948



Newburgh



Newburgh





Stone farmhouse  
near Moscow



Stone farmhouse  
near Camden East



Thompson house  
Camden East



Clapboard house  
near Strathcona





and Addington. The court-house is both substantial and elegant, and standing as it does on elevated ground, away from the busy part of the town, is an ornament to the place. Of late years Napanee has made extraordinary progress, in almost every respect. In population there has been a marked increase since the year 1856, when the inhabitants of the village numbered some 1500. In 1871, the number had increased to 3,000, and the present population cannot be far short of 5,000 . . . . To the manufactories, mills, lumber business, and other branches of industry, the town no doubt is indebted for its immense progress during the last few years. The Napanee River is navigable as far as the town, where there is a natural fall of the water of about thirty feet, and the facilities for propelling machinery are very great."\*

In the matter of population, the chronicler seems to have let his ambition run away with him, for the census returns for the year 1881 gave the number in that year as 3680, and thereafter the numbers began to decline. A bird's-eye-view pictorial plan of Napanee, dated 1874, and reproduced in Herrington's History of Lennox and Addington, shows two schooners on the river above the Centre Street bridge (which appears to be a swing bridge), and one schooner (loading lumber) just below the bridge; while there are three steamers shown, two under way and one docked beside Dey's Tannery, all below the Centre Street bridge. The depth of water in the estuary of the Napanee River was six feet, and it is possible that the artist who designed the plan was idealizing the capacity of the "harbour" of Napanee rather than recording the actual traffic. Throughout most of the period of its known history, the Napanee has been valued more for its water power than for shipping; nevertheless, Herrington states (page 238) that "it was a common occurrence to see four or five schooners loading at a time, and the merry call of the workmen and deck-hands could be heard from sunrise to evening". The commodity most commonly shipped was lumber.

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\* Historical Atlas of Frontenac, Lennox and Addington.  
Page 14.



Despite the confident enthusiasm of her admirers, Napanee remains in 1957 an incorporated town with a population of approximately 3,900.

It has been pointed out that the earliest ministrations of the Church of England to the people of Napanee were those of the Rev. John Langhorn, as he officiated at meetings in private houses at "St. Oswald's" on the south bank of the river, in the "Parish" of Fredericksburgh, from 1789 to 1813. Mr. Langhorn was succeeded by the Rev. John Stoughton, who continued the plan of periodic visits to Napanee, at least until 1820, and remained as a missionary at Bath until his death in 1835. In accordance with the Bishop's intentions, Mr. Saltern Givins was duly ordained, and appointed to the charge of the Mohawk Church, near the present site of Deseronto, whence he made fortnightly visits to the little congregation at Napanee, who, until 1835, were without a church of their own.

The Parish Record of Napanee, preserved in the Synod Office of the Anglican Diocese of Ontario, at Kingston, begins with the following somewhat inaccurate summary of the first half-century of its history.

"Napanee Rectory Visited by Rev'd. Jno. Langholme (sic) from Bath in the beginning of the Century. First regular Clergyman, Rev'd. Saltern Givens, fortnightly service, from the Indian Woods. St. Mary Magdalens Church, Stone, and Glebe Given by John Solomon Cartwright Esq'r., M.P. for Lennox and Addington, in 1840."

The property that was deeded to the Bishop of Toronto on the 16th July 1840, consisted of one-and-a-half acres, part of Lot 23, 1st Concession, Township of Richmond, and was located at the north-west corner of Thomas Street and the Newburgh Road. A part of the property, just west of the corner lot, is still kept as a cemetery.

The first resident rector was the Rev. William Bernard Lauder, also a missionary of the S.P.G., whose incumbency was from 1849 to 1862, and who in turn was



succeeded by the Rev. James John Bogert, rector from 1862 to 1881. A rectory was built in 1864.

By the year 1873, the growth of the town toward the west had made the location of the church inconvenient, and a new location was found at the corner of Bridge and Robinson Streets, the present site. The Parish Record gives a very brief summary of the changes involved in the move.

"Stone Church pulled down, and handsome new Church on new site about a mile to the West begun 1873, partially completed 1877. The Rectory House was not quite finished, and the Grounds improved until 1882. The New Church of St. Mary Magdalen still (1884) needs the tower, and the Grounds require to be fenced. The Cost so far is about \$25,000."

The first regular preacher of the Methodist denomination in Canada was the Rev. Wm. Losee, a Loyalist who had known some of the settlers in Adolphustown before they had left the United States. He first visited the country in 1790, when he preached at a few points along the Bay of Quinte. In 1791, he came again as a regularly appointed minister from the Methodist Episcopal Church of the United States. There was then no Methodist Church building, the preaching places being in private homes, or in taverns. One such place of meeting was the tavern of Conrad Vandusen, in Adolphustown; another was the home of Paul Huff, on the shores of Hay Bay. When the congregation at Hay Bay outgrew this accommodation, they decided to erect a church. Paul Huff donated the land for this purpose, and the church was built, in 1792. This church, substantially unchanged since it was first built, celebrated its 160th anniversary on August 24, 1952.

It was not until nearly fifty years later that a Methodist Church was built in the vicinity of Napanee. In the autumn of 1839, the Wesleyan Methodists began to build a church in Newburgh; it was completed and opened for worship "early in May", 1840. At the same time, preparations were being made for the erection of a church in Napanee. On a lot of land that had been donated by John Solomon Cartwright, the



corner stone of the Wesleyan Church was laid, June 9, 1840, and the building was commenced of "the first Brick Chapel in the Midland District".\* The following Christmas, this church was the recipient of the gift of a stove; this seems to indicate either that the church was at that time completed, or that its completion was expected soon. The site of this church was that of the present United Church, at the corner of Bridge and John Streets.

Five years later, the Methodist Episcopal Church entered on a similar program of building. In 1844, they began a church in Napanee, which was more than two years in the building; it was finished and dedicated on March 18, 1847. The land on which it was built, like the sites of the Church of England and the Wesleyan Methodist Church, was the gift of John Solomon Cartwright, who is said to have given the land for "every church in Napanee". While the church at Napanee was in process of construction, two others were making progress, and one at least was built and opened for use. In October, 1845, a site was obtained for a church at "Bower's", the present village of Strathcona; and by the 16th of July, 1846, "we have erected a comfortable meeting house upon it". And on the same date, it was reported that land had been obtained in the centre of Camden, now Centreville, "for the purpose of a burying ground, and erecting a Church upon it".†

In addition to the meeting houses at Napanee, at "Bower's", and in Camden, the Methodist Episcopal Circuit of Napanee included a small congregation at "Kimmerly's settlement", located on the road to Deseronto, about four miles from Napanee. According to the Report of the Treasurer of the Bay of Quinte Conference in 1846, there was "collected

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\* Details of the events referred to in this paragraph were recorded in the Christian Guardian, July 1, 1840 and Jan. 6, 1841.

† Canada Christian Advocate, the official publication of the Methodist Episcopal Church in Canada, various dates in 1845, 1846, and 1847.



by Miss Abbott, in Kimmerly's neighbourhood, 27s. 7 $\frac{1}{2}$ d.", for the work of the Church. At the same time, there had been collected in Napanee, 126s. 9d.; and at Bower's Chapel, 51s. 2 $\frac{1}{2}$ d.

A feature of the ministry of the Methodist Church was the occasional "donation", made necessary by the meagreness of the salaries paid to the ministers. In addition to relieving the needs of the ministers, these occasions played an important part in the social life of the communities concerned. The following advertisement is taken from the Canada Christian Advocate of May 5, 1846.

"DONATION VISIT.- The Friends of the M.E. Church, on Napanee Circuit, are respectfully invited to attend a Donation Visit, at the Residence of the Rev. I.N.D. West, in the Village of Napanee, on Wednesday, the 3rd day of June next, at 2 o'clock, P.M., for the benefit of the Preachers stationed on that Circuit."

A similar donation party was held in the Wesleyan Methodist Church, at Wilton, in Ernestown, on the 13th of January, 1860, for the benefit of the ministers of the Wilton Circuit of that church, with "refreshments served at 12 $\frac{1}{2}$ ".

There were in the Bay of Quinte settlements fewer of Presbyterians than of either Anglicans or Methodists, and for that reason the practice of holding services in private houses persisted longer among them. Major Peter Vanalstine, the leader of the settlement in Adolphustown, was a Presbyterian of Dutch origin, and it was he who brought to Canada the first Presbyterian minister to undertake the work of his church on the shores of the Bay of Quinte, the Rev. Mr. McDowell, who came to Canada in 1800 and settled in Ernestown. His "circuit" extended from Brockville to the Carrying Place at the head of the Bay of Quinte.

In a letter addressed to the editor of the "Ecclesiastical and Missionary Record", dated March 18, 1851, the Rev. Robert F. Burns, of Kingston, gives a combined



description of the village of Napanee and of the State of Presbyterianism in that community.

"This village stretches along the high road - exactly between Kingston and Belleville, being 25 miles distant from each. It skirts the borders of a river of the same name which mingles its waters with those of the noble Bay of Quinte seven miles off - is as wide most of that distance as the Clyde at Govan, and deep enough to float vessels of average dimensions. This powerful water privilege has been much in favour of Napanee, and while sufficiently explaining its present comparative prosperity, it furnishes a guarantee the most sure and satisfactory for its future advancement. A few years ago, the traveller could see nothing save a grist and saw mill, a tavern and a store - the stereotyped nucleus of a Canadian village. Now, his ear is arrested by the sound of revolving machinery from three or four different quarters, and the cheerful hum of a brisk and busy population, while a score of shops, some of which would do no discredit to your ambitious metropolis, attract the eye.

"Three churches have already been erected, one Episcopalian and two Methodist - and even a weekly paper has been started, glorying in the somewhat ambiguous title of the 'Bee'. The surrounding country is well adapted for agricultural purposes, and is being rapidly filled up with rich and respectable settlers. The possession of such an easy outlet for grain, lumber and every species of commodity, renders the locality peculiarly eligible for the industrious emigrant.

"Religious and educational advantages at first but scantily enjoyed are now being superadded to an extent in some measure commensurate with its growing importance. There are several who profess to belong to our church both in the village and its vicinity. During the sojourn of our friend Mr. Wightman in the adjoining township of Camden, supply more or less regular was given them, since his removal (an event deeply deplored by not a few) they have wandered as sheep without a shepherd. No doubt, during one season a slice of one of our Catechists labours was allotted them - and individual members of Presbytery have repeatedly preached, but nothing like a pastoral oversight has been exercised and our visits have at the best been rather Angelic - 'few and far between'.

"Nevertheless, our cause though 'cast down' has not been altogether destroyed. At no previous period were we more deeply impressed with the importance of getting it revived and securing for ourselves a firm footing, than during our last visit. The few who continued to rally round the standard of freedom wore a more hearty and hopeful aspect. At a meeting held after the public service in the W. Methodist Chapel, (always kindly thrown open



"to us) we had a most agreeable conference with them, and a Committee was appointed to consider the feasibility of our recommencing operations, and if possible to adopt immediate and vigorous measures for an efficient reconstruction of the dilapidated framework."\*

Not until 1864 did the Presbyterians provide themselves a place of worship in Napanee; in that year they began the building of a stone church, the basement of which was dedicated and opened for use early in the spring of 1865. The main body of this church was completed in 1869.

The first Roman Catholic Church in Napanee was built in 1856, the same structure that is still in use in 1957. Before the building of this church, Napanee had been part of a missionary parish that included also Adolphustown, Fredericksburgh, Richmond, and Deseronto, with occasional Masses celebrated in the homes of the people. The parish was divided in 1906, when for the first time, Deseronto was constituted a separate parish, with a priest of its own.

The account of Napanee given in Smith's Canadian Gazetteer of 1846 states that the village "contains about 500 inhabitants". During the ensuing thirty years, growth was rapid, until in 1881 the Dominion Census showed a population of 3,680. The period of expansion was followed by another thirty-year period of decline, in the course of which the population fell to 2,807 in 1911. Most of this loss was again made up in the years between 1911 and 1931; there was a slight falling off in the 'thirties; and a new burst of growth in the 'forties. The Dominion Census of 1951 showed the population of Napanee at a new "high" of 3,897; according to the Ontario Municipal Directory for 1957, the present population is 4,232.

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\* Ecclesiastical & Missionary Record, April, 1851: page 84.  
(In Victoria University Archives.)







## 2. Strathcona

The first significant rapids in the Napanee River above the town of Napanee occur in the interval between five and six miles from that place; here the river falls some twenty-five feet in the mile, and here

"In the early twenties of the nineteenth century Adam Bowers built a mill at the foot of the rapids, and the place was for many years known as Bowers' Mills. Adam was a Lutheran and brought his children up in the same faith; and his son John built a stone church upon his farm at the Mills."\*

At Bowers' Mills, in October 1845, the Methodist Episcopal Church obtained a site for the purpose of building a place of worship. The congregation lost no time in carrying this purpose into effect, for the Canada Christian Advocate, their official publication, records that, on January 24, 1846, a meeting

"was held in Bowers' Chapel, a distance of about five miles from the village of Napanee in the direction of Newburg."†

About 1850, an American firm bought out the Bowers' privilege, and undertook lumbering operations on a large scale; and the hamlet came to be known as the Yankee Mills. In 1861, a post office was established, and the name selected for it was Napanee Mills, one that gave rise to great confusion; because it was common practice to refer to the early mills at Napanee as the Napanee Mills, and because the mills built in Napanee by "the estate of the late John S. Cartwright, M.P.P." in 1846 had been named the Napanee Flouring Mills.

In the early seventies, the mills at Napanee Mills were sold to H.M. Wright and Company, who organized the Napanee Paper Company, tore down the sawmill, and built a paper mill on its site. While the paper mill continued in operation, the Wrights became interested in a new venture. It was

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\* Herrington, W.S. Op. cit., page 284.

† Canada Christian Advocate, March 12, 1846, page 1, col. 3.



Power Canal  
Napane



Yarker  
about 1908



Broken bridge  
Petworth 1907



Cement works  
about 1900  
Strathcona





discovered that the limestone formation on which their mills stood provided suitable material for the production of Portland cement.

"A cement plant was erected, and enlarged from time to time, dwellings for the workmen were built and a large number were removed from Napanee . . . The Star Brand of Portland Cement manufactured on the old Bowers' farm acquired a reputation for excellence second to none on the continent. These were the days of prosperity for Napanee Mills, whose weekly wage bill exceeded that of any village upon the river. The place wore an air of contentment, every house was tenanted, the large boarding-houses were filled to their utmost capacity, the corner store did a thriving business . . . . "

This air of prosperity lasted for some years, but could not survive the changes that those years brought. The supplies of raw material for the paper industry became exhausted, and the paper mills were closed. The cement company was taken over by another concern, who removed it to Marlbank, one of the sources of its raw material. The extensive cement plant was dismantled, about 1904, leaving only a broad scar across the face of the hill that overlooks the Napanee River, and an undated photograph clipped from an unidentified publication.

At the close of the South African war, the name of the village was changed to Strathcona, in honour of one of the leaders in that war; and Lord Strathcona, then Canada's High Commissioner to London, gave \$1,000 to a public library in the village.

At a later date, a new paper mill venture was established at Strathcona, which has for many years been the principal industry in that vicinity.

### 3. Newburgh

The village of Newburgh is the second largest centre of population in the Napanee Watershed. During the last ten years of the eighteenth century and the first decade of

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\* Herrington, W.S., op. cit., page 286.



Newburgh Academy



School  
Camden East



Abandoned schoolhouse  
at Sangster  
Bedford Township



School  
Enterprise





the nineteenth, most of the farm lots in the first and second concessions of Camden Township had been taken up and settled. The two lots in the second concession on which a large part of Newburgh stands, Nos. 16 and 17, had been granted in 1789 to Robert Perry, and patented by him in 1802. The holders of these lots, however, received them, and operated them, as farms, with no evident intention of establishing a village.

The founding of Newburgh is considered to date from the year 1822, when two cousins, Benjamin Files and William Van Pelt Detlor, took up land on Lots 16 and 17 on the south side of the river, in the first concession of Camden. Another account states that David Perry, son of Robert Perry, was the first white man to build a house in Camden, and that Perry's house became the beginning of Newburgh. "His location was on the hillside in the north end of the village on the west side of the present Main Street." The date of the building of David Perry's house has been fixed as 1820, and it seems probable that it was not the first in the township, but if the date, 1820, is correct, then David Perry was one of the settlers to whom the newcomers in 1822, Files and Detlor became near neighbours. And when, in 1824, David Perry built a sawmill here, and when, in 1825, John Madden built a second sawmill, "The Hollow" was marked as the centre of a growing village. Further steps in its growth were the building of a grist mill by David Perry, in 1826, and of a second grist mill by John Madden, in 1831.

John Black started a tannery in 1832, which, thirty years later, was stated to be turning out 2,500 pieces of leather per annum. In 1840, Douglas Hooper established the Union Flouring and Grist Mills, containing "three run of stones, and one barley stone", in a building "built very substantially of stone, three stories and a half high". Adjoining it was another stone building, an oatmeal mill, erected in 1861. By 1865, the same proprietor, Douglas Hooper, had added a woollen mill, "a fine stone building, 64 feet x 34 feet,



three and a half stories in height, which will be in full operation during the coming season".

Newburgh was fast becoming a very active industrial community. Besides the mills noted above, there were in 1865 two carding mills, two axe factories, one foundry, an agricultural implement factory, manufacturing reapers, mowers, and threshing machines, a sash, blind, and door factory, three carriage and wagon shops, a hub and rake factory, and two cabinet factories.

In a review of the history of Newburgh, written by George Anson Aylesworth, and quoted at length by Herrington in his "History of Lennox and Addington", there is an account of the value of the water privileges at Newburgh. "The Napanee River, about one quarter of a mile east of Main Street, divides into two branches, which re-unite about an equal distance west of Main Street, thus inclosing an island of about seven acres in area . . . . This double river affords no less than thirteen good water privileges within less than one third of a mile. These have been valued and made of great utility in times past; and in these later electric days the time of their appreciation is again dawning." The Rev. John Ryerson, visiting Newburgh in 1841, referred to the village as a "very thriving business place, of a population of 200 souls". In a Directory of Canada, published in 1869, this number was reported to have increased to 1,500, and a mere list of the industries of Newburgh occupies no less than twenty-three lines of print. At least two more were about to be added to that list.

In 1871, John Thomson, a young man of Scottish birth, who had emigrated with his family in 1854 to the United States, and had served his apprenticeship in a paper mill in the State of New Jersey, came to the Napanee River and selected a site at Newburgh on which to build the mills of a company that consisted of himself, his brother, and a partner named



Rooklidge. According to an account published in 1909 by the Lennox and Addington Historical Society, this paper mill was built "on the small island where Stickney's foundry now stands".

The Historical Atlas of Frontenac, Lennox and Addington Counties, published in 1878, shows a "mill" on the island that may have been that of the Thomson firm; it also shows a large "paper mill" on the main land on the south shore of the river at Newburgh, of which a part remained in recent years as Breeze's sawmill, the rest being traceable only as an extensive ruin overgrown with a jungle of Manitoba maples. A directory of Lennox and Addington, compiled by the Union Publishing Company in 1888, lists two paper mills at Newburgh, one in the name of James Thomson (presumably the brother of John Thomson), the other in the name of the Napanee Mills Paper Company. John Thomson remained a partner in the Thomson-Rooklidge firm only until 1874, when he built another paper mill at Napanee Mills (later Strathcona) for the Napanee Mills Paper Manufacturing Company. In 1881-82, he built still another paper mill, this time about a mile below the village of Camden East, known as the Thomson Mills. In this new enterprise he remained active only until 1887, when he retired to live in Napanee.

The directory of 1888 lists no less than six paper mills on the Napanee River: one at Napanee, one at Camden East, two at Napanee Mills (Strathcona), and two at Newburgh.

An institution of which Newburgh has long been proud is the Newburgh Academy. The date of its first establishment is not exactly known, but the best estimate of one investigator, George Anson Aylesworth, already quoted, gives 1839 as the most probable date.

Mr. Aylesworth continues:

"The Academy is the ancient glory and the present pride of the community. Established when the



"community was very young, we find it flourishing under the governance of a Presbyterian minister, the Rev. Mr. Wightman, in the years immediately following the subsidence of the Rebellion (1837-38) . . . . . As early as 1844 the Academy became a Model School . . . . . Newburgh deserves well of this country for its Academy's sake. It has given to the churches a great host of eminent and distinguished reverend gentlemen, of school teachers beyond computation, and of physicians far too many to be named. Upon each of the three contiguous counties composing the old Midland District, Frontenac, Lennox and Addington, and Hastings, Newburgh Academy has conferred its Judge upon the bench. Of other learned lawyers and able statesmen, orators and politicians a multitude . . . ."

The original building became too small, and was replaced by a large new building in 1853. This, in turn, was gutted by fire in January, 1872, and was replaced by a third building, which still remains.

The first church building in Newburgh was the chapel of the Wesleyan Methodists, begun in 1839 and opened for worship in 1840. In 1856 the Wesleyans began a new church of stone, which was completed and dedicated in 1858, and which still remains. It is of this church that Aylesworth says:

"The Methodist church was planned large in order to accommodate the expansion, at that time not unreasonably expected. But in common with nearly all other Ontario villages and smaller towns, growth has been slow . . . This needlessly large church was adorned with a large pipe organ in 1899, the gift of the late John Shibley, to honour the memory of his parents."†

The Methodist Episcopal congregation built their first church in Newburgh in the year 1862, a frame structure in the north part of the village. Within a few years of its erection, this church was destroyed by fire; it was replaced by a stone church on the Main Street between the two bridges, and accordingly on the island that forms the centre of the village. This building later became the property and place of worship of the Presbyterians, and after the union of that

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\* Herrington, W.S., op. cit., page 296.

† Herrington, W.S., op. cit., page 294.



denomination with the Methodists became the Newburgh Community Hall, a function which it still performs.

In 1865, according to Mitchell's Directory, the Anglicans of Newburgh "at present hold their services in the town hall". Not until 1881 did they have a church of their own, when the present stone edifice was dedicated.

Newburgh was incorporated as a village in 1858-59, with Augustus Hooper as its first Reeve. The village seems to have attained its greatest population between 1865 and 1869, and to have dwindled steadily from that time until 1921. Since 1921 the census records a new period of growth, by which, in the ensuing thirty years, the population had increased by about one hundred, until in 1951, it was reported to consist of 509 persons.

According to the Historical Atlas of Frontenac, Lennox and Addington, the Township of Camden East "has the honor of issuing a weekly paper, called the Addington Advertiser, which is well managed, and published at Newburgh". Herrington's history does not mention the Advertiser, but gives an account of the publication and ultimate failure or removal of four others, all weeklies. The Index, begun in 1853, continued until about 1860. The British North American made its first appearance "on the eve of the decisive battle for the separation of the counties" (1863), and remained in publication less than a year.

The Newburgh Reporter was first published in 1875, but in 1880 "was allowed to die a natural death". In 1870, the Addington Beaver was published in Newburgh, and within a year or two was moved to Napanee, where it still continues in business. Since Herrington illustrates his account with a photographic reproduction of the newspapers he describes, and in the photograph includes the Addington Reporter of November 22, 1876, published at Newburgh, it seems likely that the reference in the Historical Atlas of 1878 to the Addington Advertiser is in error, and should refer to the Addington Reporter.



Thompsons Mills  
(Grist Mill)  
Camden East



Ruins of Thompsons  
Paper Mills  
Camden East



Ruins of Mill  
at Petworth



Grist Mill  
Newburgh





4. Camden East

Two miles upstream from Newburgh is the village of Camden East, which had its beginnings in the building of a dam and sawmill in 1818 by Abel Scott. The original mill was located some distance above the present site of the village, where the dam caused much damage by flooding the adjacent lands. Scott sold his privilege in 1821 to Samuel Clark, whose grandfather, Robert Clark, had built the government mills at Cataragui, in 1784, and at Napanee, in 1786. "A small village, principally for the accommodation of his employees, sprang up, and was known as Clark's Mills, by which name it is still called by many of the old residents. Clark was a prominent member of the Church of England, donated the land upon which St. Luke's church stands, was a liberal contributor towards the building fund, and personally superintended its erection."\* This was the first Church of England in Camden East Township; it was opened for divine service on March 29, 1844.

Samuel Clark, when he first came from Ernestown, built three mills, a sawmill, a grist mill, and a carding and fulling mill. Not many years after, these three mills were all destroyed by fire. Clark rebuilt the grist mill of stone, and once again it was burned. In the early forties, the woollen mill was again burned; and in 1865, the rebuilt sawmill met the same fate. Recurrent floods damaged, on one occasion, his mill-dam, and on another his mill yard, sweeping away a large quantity of lumber; at another time, his log-boom burst, and a considerable stock of logs was lost. In 1836, a post office was established in Camden East, with Samuel Clark as the first postmaster, a position that he continued to hold until his death in 1866.

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\* Herrington, W.S., op.cit., page 303.



Camden East  
1948



Camden East



Court House  
Napanee  
1948



Colebrook  
1910





Mitchell's Directory of Frontenac, Lennox and Addington, 1865, supplies the following further particulars.

"About half-a-mile west of Clark's mills are situated the Addington Mills, on the same river. These mills were established, in 1850, by George Empey, but are now owned and carried on by G.C. Bogart. Three run of stones, with one merchant and two custom bolts are used, manufacturing about sixty barrels per diem. Hooper's saw mill was established, in 1840, by A.F. Hooper, Esq., ex-M.P.P. for Lennox and Addington. The mill is half-a-mile west of Clark's mills on the Napanee river. It contains two gangs of saws - one upright saw and five circulars. Three million feet of sawn lumber are turned out from this mill per annum."

In 1865, the Directory states, "the Wesleyan Methodist Church is in course of completion, and is estimated to cost two thousand dollars".

W.S. Herrington traces the early history of Camden East back to a much earlier period than that of the building of the first mill by Abel Scott. "Isaac Cote', a trapper, is said to have been the first white man to occupy any portion of the land upon which the village now stands. In the latter part of the eighteenth century he built a log cabin, the ruins of which Mr. Lockwood remembers having pointed out to him over seventy years ago". (Since Herrington's work was published in 1913, this reference is to a date earlier than 1843.)

Many years before the date of Abel Scott's mill, Albert Williams moved from the Township of Fredericksburgh and settled on Lot No. 25 in both the first and second Concessions of Camden East. At some time between 1800 and 1804, he built on the south bank of the river his first house. A few years later, after there was a bridge over the Napanee River at Camden East, he built a new house on the north bank. In 1881, Lorenzo Dow Williams, grandson of Albert Williams, built upon the same property "the most imposing farm residence in the county", a three-storey brick house in the construction of which a large quantity of white marble was used, said to have been hauled in the winter on sleds from the Bridgewater



Quarries, near the present Actinolite. The rough quarried stone was dressed in a field near the site of the house as it was required during the building operation.

5. Yarker

As part of the lands to which he was entitled as a military officer, Governor John Graves Simcoe was granted, in 1796, a tract of land in what was then an unexplored wilderness in the south-eastern part of the Township of Camden East, consisting of Lots 39, 40, 41, 42, and 43 in the first Concession of that township, and comprising one thousand acres, known for many years as the Simcoe Tract. Upon the death of Governor Simcoe, the tract passed to his third and only surviving son, the Rev. Henry Addington Simcoe. "To the north of the Simcoe Tract was a hamlet called Peters' Mills, now the Village of Colebrook, and four miles to the south was the Village of Wilton". Interest in the tract centred chiefly in the potential water power that might be developed from a waterfall 26 feet high on Lot 42.

One of the leading citizens of the Village of Wilton was Sidney Warner, maker of potash and proprietor of a large general store. In 1840, Mr. Warner bought the Simcoe Tract, and sold to George Miller that part of Lots 41 and 42 north of the river, and the corresponding piece on the south bank, to David Vader, who built a sawmill at the falls on Lot 42. The village that grew up about this mill came to be known as Simcoe Falls. In the late forties, George Miller built on his side of the river a grist mill and a carding mill. A few years later, in 1852, Joseph Connolly bought part of the land of David Vader, on the south bank of the river, and there built a foundry and plough works.

The village continued to be called Simcoe Falls until 1859, when it was proposed to establish a post office here, and the Government objected to the name because of its



similarity to the name of Simcoe, in Norfolk County. At a public meeting several suggested names were considered, and it was finally decided to propose the name of Yarker, in honour of Mr. George W. Yarker, of Kingston, owner of a number of mills in the vicinity; and the name was accepted.

New mills and industries were added, and many changes of ownership took place; and Yarker continued to grow. George Miller's mills on the north bank, once burned and rebuilt, were sold to Alexander McVean. Garrett and Anthony Miller built a tannery on land adjoining the grist mill, and the tannery was converted into a pail and fork factory. In 1863, this factory and McVean's mills were destroyed by fire. McVean rebuilt the grist mill, and sold it to Messrs. Connolly and Benjamin, who in turn sold it to George McDonald. McDonald sold it to Jas. Richardson and Son; Richardson sold it to James H. West, and West sold it to James Freeman.

On the south bank, David Vader, after Connolly's foundry was established, sold the remainder of his property to Samuel Scott. The sawmill built by Vader was burned, and Scott sold the mill site to Messrs. Booth, of Odessa, who built a woollen mill on it; the Booths sold it to Messrs. Lott and Stevenson, who in turn sold it to Peter Ewart. While it was in Ewart's possession, it was burned. The mill site and water privilege were then sold to E.W. Benjamin, who built upon it a power house. In 1952, after foundry, woollen mill, and power house had all disappeared, workmen salvaged the power house machinery from the ruins, to be disposed of for other purposes. McVean's mill, on the north bank, still remains.

According to Mitchell's Directory, 1865, the following were at that time the industrial activities of Yarker.

Booth, John & Joshua, saw mill proprietors  
Conolly, Joseph, foundry and machine shop  
Conolly & Benjamin, hub manufacturers



Last Drive  
on the Napanee  
Colebrook  
about 1905



A boom of logs  
at Colebrook  
about 1915.



Log boom  
Colebrook  
about 1905



Yärker  
about 1905





McKean McVean, A., J.P., flour and grist  
mill proprietor  
Shibley, John A., J.P., postmaster, saw mill  
proprietor, general merchant, notary  
public, and commissioner in B.R.  
perhaps, bankruptcy  
Wood, Hazelstine & Carscallen, sash, blind &  
door manufacturers and planing mill  
proprietors

And in 1869, Anderson's Directory of Ontario  
reported the following industries in Yarker.

Benjamin, E.W., foundry  
Booth, A.P., woolen manufacturer  
Conelly, Joseph, foundry  
McVean, A., flouring and grist mill proprietor  
Shibley, John A., lumber merchant  
Waitman, Peter, foreman planing mills  
Woodhouse, Edward, wagon maker

The next available directory is the Farmers' and  
Business Directory of Frontenac, Addington, Lennox and  
Prince Edward Counties, published in Ingersoll, in 1888. This  
shows a few further changes:

Benjamin West & Co.	sarven wheels <u>hubs</u>
Ewert, Peter, & Son	woolen mill
McDonald, George	milller
Wartman, Peter	sawmill

## 6. Colebrook

About a mile north-east of Yarker, on Lots 44  
and 45, in the second Concession of Camden East, is the  
village of Colebrook. Lot 45 was originally held by Eli  
Peters, who built a sawmill on the Napanee River at this  
point; on a map of the Midland District, made in 1836 by the  
surveyor, P.V. Elmore, the site is marked Peter's Mills, a  
name which persisted for many years. The mill was at first  
equipped with one saw only, an upright one; and when business  
increased a second saw was added.

Lot 44 was occupied by John Gordon. In 1842,  
all of the Gordon lot, and the mill site of the Peters farm,  
were bought by Charles Warner, a brother of Sidney Warner who  
bought the Simcoe Tract. Charles Warner

"built a store, the first one in the place,  
installed a circular saw in the Peters' mill,  
laid out the land about the falls in village



"lots, and began business on a most extensive scale, sawing as much as 750,000 feet of lumber in one year . . . . . When the logs began to arrive two shifts of men were employed and the mill kept running night and day. Little care was taken either to preserve or properly dispose of the refuse material; the saw-dust was allowed to drift away as best it could, and the slabs were dumped out of the end of the mill into the water . . . . . The first grist mill, which also passed into the hands of Mr. Warner, was built over seventy years ago before 1843 by an Englishman, John Rouse."\*

Through the influence of the Warner brothers, Peters Mills obtained a post office before Vader's Mill, and the name of the growing village became Colebrook. The change brought increased business to the Warner enterprises, and prosperity to the Warner family. The state of business was reflected in the new stone residence, built in 1855, which, more than a hundred years later, is still one of the landmarks of the village.

According to Herrington, a flood on the Napanee about the year 1863 ("fifty years ago") carried away the bridge at Colebrook, and a ferry was in use until the bridge was replaced.

The Directory of 1865 refers to Colebrook as a flourishing village with a population of about 250; and among the business enterprises names the following:

Shibley, Charles, saw mill proprietor.  
Warner, D.S., flour and saw mill proprietor.

Colebrook has one church, now the United Church of Canada, built in 1874 as the Methodist Episcopal Church. The present square tower of this church was originally topped with a tall slender spire.

In 1877, the village suffered a disastrous fire that swept the west side of the river, destroying a sawmill, three stores, two hotels, and five dwellings.

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\* Herrington, W.S., op. cit., page 317.



Mill at Yarker



Mills and Pump  
Turnery Colebrook



Wooden Pump Worker  
Colebrook



A new wooden pump made at Colebrook,  
in use at Newburgh 1948.





7. Moscow

The Loyalists of 1784 had made their homes along the shores of the Bay of Quinte, chiefly in the first four townships: Kingston, Ernestown, Fredericksburgh, and Adolphustown. As these townships filled, and new land on the "front" began to become scarce, the sons of the early settlers turned to the regions farther inland, and first explored and later settled the country on the upper reaches of the rivers whose mouths their fathers had found so useful as a source of power and as channels of communication.

Prominent among the families that settled in the Township of Fredericksburgh were the Huffmans, Elias and his cousin Michael. Two sons of Elias Huffman, Elijah and Jacob, became the first settlers of Moscow, three and a half miles north of Colebrook.\*

Elijah Huffman was a hunter with a genius for exploration. In the autumn of 1823, when he was thirty years old, one of his hunting excursions took him far into the almost unknown country between the Napanee and the Salmon Rivers. Arriving at a post recently planted by a surveyor to mark the line between the Fourth and Fifth Concessions of Camden Township, Elijah was impressed with the majestic forests and the richness of the soil, and formed the intention of making his home there. Returning home to Fredericksburgh, he interested his family, and early the following summer, he and his brother Jacob set out to revisit the spot that had so attracted him.

"They travelled by the same blazed trail followed by Elijah the season before. This trail led from where Napanee now stands, north along the west shore of the Napanee River, following the high land in the Township of Camden, past Clark's Mills

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\* This account of the village of Moscow is based on the "History of the Pioneers in the Moscow District", an unpublished work compiled in 1941 by Mr. Joseph Foster, of Moscow; from which work, with the author's permission, the quoted passages are excerpted.



"to a point midway between Varty Lake and Mud Lake, and then eastward to the location where Moscow now stands. After locating the Surveyor's Post, they made a careful examination of the whole surroundings and finally decided to locate one mile east of the Surveyor's Post and not far from the boundary of the County of Frontenac."

Elijah selected Lot 48 in the Fifth Concession, while his brother took the adjoining Lot 49, and here, through the summer and autumn of 1824, they made their first clearing, and prepared the logs that were to be used in the erection of "the modest log cabins" that were to be their homes. The two log houses were completed in the summer of 1825, and the beginnings of Moscow had been made.

William Foster was a brother-in-law of Elias Huffman, who had settled in the Township of Sophiasburg. Joseph Foster, his son, was married in 1826, and with his bride spent their honeymoon visiting their cousins, Elijah and Jacob Huffman, at their wilderness home in Camden. As a result of this visit, Joseph Foster joined his cousins in their undertaking, and settled on Lot 50 in the Fourth Concession, almost immediately across the road from Jacob Huffman's home. At about the same time, Peter Huffman, a son of Michael Huffman, and accordingly a second cousin of Elijah and Jacob, settled on Lot 51 in the Fourth Concession of Camden; and in 1827, Samuel Foster, a brother of Joseph Foster, joined the venture by settling on Lot 48 in the Fourth Concession. Then "Caleb Brown, Stephen Card, and John Card selected farms on the west side of Moscow, near Mud Lake, and so these seven families formed the nucleus of the settlement, which afterwards became known as 'The Moscow District'". Between 1830 and 1836, several families moved in, among them the Asselstines, the Potters, the Ameys, the Clarks, the Bakers, the Simmons and the Benns.

As there was no church in the growing community religious services were held in the homes of the people, and



sometimes in new barns, "before they were used for the storing of crops". The early settlers were mainly Methodists, both Wesleyan and Episcopal branches being represented. "There were also a considerable number who belonged to the Church of England, and quite a number of 'Orthodox Quakers', later known as 'The Society of Friends'".

"The Episcopal Methodists in 1865 built the first Methodist Church, on the site of the present Moscow Cemetery, and was known as the 'White Church'. It was a substantial structure and well built. .... The Wesleyan Methodist Church was built in the year 1869, a substantial stone structure, and since the union is known as 'The United Church'".

"Very early in the history of the Huffman Settlement, the followers of George Fox, founder of the religious sect known as Quakers, built the first Church for religious worship in the Moscow District and was known as the 'Friends' Meeting House'. It was located in the Village of Moscow immediately opposite the general store. The building was of frame construction, facing west and had two doors on the front side, one for the women and one for the men. The rostrum was located at the rear, and a partition, which ended at the platform, divided the building into two Meeting Houses, one for the women and the other for the men. The Preacher, standing at the centre of the platform, could be seen from either side."

"The Society of Friends later moved and re-built their church with brick, across the highway from the Methodist Church. Changes came and the years that followed took their toll of the membership of this once progressive Church until none remain, and the Society of Friends, insofar as Moscow is concerned, remains but a matter of history."

Being a predominantly agricultural community, the Moscow District covered a wide area, and the provision of suitable school facilities became a problem. The first school was called the Huffman school, and was located about a mile east of the cross-roads that mark the centre of Moscow. "It was conducted in a small cottage building, sixteen feet square, and known as Clark's Weave-shop. . . . It was only a short time until the Weave-shop was crowded to capacity and it became necessary for the community to consider the erection of a suitable school house." Jacob Huffman donated a quarter-acre of land on the north-west corner of his



recently acquired Lot 49, Fourth Concession, and there the new school was built, "thirty feet square, one storey high, and covered with a cottage roof".

The Perry school was located on the north-west corner of Lot 45, Third Concession, on the farm of Calvin Perry.

The Card family settled on Lots 41, 42, and 43, in the Fifth Concession, and the school that was built on Lot 43 was known as the Card school. It was about a mile north-west of the centre of Moscow.

"The Potter school was of log construction and built on the corner of the Willet Casey Potter Homestead one mile due south of Moscow."

"In 1870 the question of consolidating the four schools into one centre institution became a live issue, and in a very short time, this practical expedient was consummated. Following the amalgamation, they all shared proportionately in building the present structure. . . . The educational movement at Moscow brought about a greater social activity among the settlers. The school buildings were available for all manner of friendly gatherings: singing schools, spelling schools and concerts sponsored by local amateurs. . . . also for religious meetings, when occasion required."

"Farming in pioneer days was an institution largely self-contained. The farm was made to produce most of the necessities of life, and the timber, grain, flax, wool, tallow and meat were processed on the premises into the finished product.

"Every settler planned on clearing at least ten acres every year. Oxen were used in the logging operations and were considered more efficient than horses and could be maintained at less expense. An ox-yoke that the farmer could make himself and a log-chain were the only equipment required. First the trees would be cut to a suitable length, rolled into heaps with the aid of the oxen and burned, the ashes made into potash, the only cash crop available, and when sold in Kingston brought forty dollars per barrel.

"The new land contained all the original organic matter and invariably produced heavy crops. The grain was cut with a device known as a 'Cradle' having five curved fingers or tines above the cutting blade, and a skilled operator would leave an even swath which would resemble a narrow boardwalk, and four acres was considered a big day's work. A second man would follow the cradler, rake and bind the swath into sheaves which required





Methodist Church, Lens  
 Roman Catholic Church, Centreville  
 Canada Methodist Church, Strathcona

Anglican Church, Newburgh  
 Church Hall and School, Camden East  
 Methodist Church, Moscow



"considerable skill, and would pride himself in making and binding a neat and tidy sheaf, when using a double band.

"The pioneers acquired livestock as early as suitable buildings could be erected to house them. It was then that the farm became a veritable factory and completely industrialised, for example: the sheep produced the mutton, tallow and wool. The wool in turn was carded, made into rolls, spun into yarn on the spinning wheel, woven into cloth on the loom. The cloth from the loom was known as flannel and was used for making women's dresses and men's shirts. For men's outer clothing, coats and trousers, the flannel was fullered or shrunk, the process consisted of placing the flannel in a tub of water treated with a chemical known as 'Fuller's Earth'. After two or three days the cloth was removed from the solution, thoroughly washed and carefully dried and pressed. The finished product was known as 'Full-cloth'".

The early agriculture gradually developed into a dairy business, and the production of butter and cheese. The first cheese factory within reach of the farmers of Moscow was built at Colebrook. Later, George Garrison built a cheese factory at Moscow, which has continued through several changes of ownership to the present day.

For the first thirty years of its existence, the Huffman Settlement continued without a post office. On April 1, 1854, a post office was established with John Crommer as postmaster, to which the name Springfield was given. One month later, the name was changed to Moscow.

#### 8. Petworth

Closely linked with the life of Moscow was that of the little village of Petworth, located on the Napanee River about two and a half miles south-east of Moscow. Joseph Foster\*, in 1840, built the first sawmill at Petworth. When, after ten years of operation, the sawmill was sold to Messrs. Stevenson and Lott, the new owners rebuilt the mill and added a carding mill and a woollen mill, and then proceeded to build a three-storey stone grist mill.

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\* Grandfather of the present Mr. Foster, whose account of the history of Petworth was added to his "Pioneers of Moscow" in 1946, and who has permitted the use of his manuscript in the preparation of this report.



"Most of the men employed by the Stevenson and Lott Lumber Company were expert lumbermen, shantymen, and river-drivers, and when the season's cut of lumber was completed at the mills and neatly piled in the lumber yard in straight rows resembling the streets of a town, part of the staff would repair to the timber limits to plan and lay out the work for the coming winter. ... Another party would be detailed to work on what was described as 'The Repairs' - this had to do with the repairing of the several dams, built to conserve the water supply during the spring drive, and thus facilitate the floating of logs and timber through and over the shallow reaches of the river."

The lumber business, which was the main-stay of the life of Petworth, got under way in 1850, and for fifty years was prosecuted with great vigour; and the village prospered accordingly. But the day came when "the timber barons had completed their job, our forest reserves of white pine were completely exhausted, the last drive of timber had passed down the River, and the people wondered what would happen next". The "history of the village of Petworth with only six families left, furnishes a striking example of what can happen to a community when its major industry collapses".

#### 9. Enterprise

In Anderson's Directory of Ontario, 1869, Enterprise is described as "a Village in the Township of Camden, County Addington, situated on Jackson's Creek, 20 miles from Napanee the County Town. Average value of improved land in the vicinity \$30 per acre. Stages to Newburgh and Napanee. Population 150". About 1855, Robert Thompson opened a general store on the north-west corner of the intersection of the line between Lots 37 and 38 with the road between Concessions 7 and 8, Township of Camden; the little hamlet was then known as Thompson's Corners. A map published in 1860 shows the village under the name of Enterprise, and gives the names of the proprietors of three stores, besides a wood-working shop, a temperance hall, a sawmill and a hotel. The hotel was on the south-east corner of the cross-roads, and was



kept by Eli Hawley; after several changes of ownership, the old house was torn down and in 1879 a new one was erected, which until recent years **continued** to serve as a public-house and hotel. In 1859, Christopher Grass built a hotel on the property next south of Hawley's hotel; this passed to Samuel Hamilton, and was known as the Hamilton House.

The first church building in Enterprise was that of the Wesleyan Methodists, which was subsequently acquired and used by the Church of England. The Methodist Episcopal Church held services for many years in the Temperance Hall; after the Methodist Union of 1884, the united Methodist body built a new brick church on the site of the Temperance Hall.

On Elmore's map of the Midland District, 1836, there is shown a sawmill on Lot 39, of the Eighth Concession of Camden, marked "Jackson's Saw Mill". Since later surveys indicate that Jackson's Creek does not flow through the lot in question, it seems likely that Elmore had the mill incorrectly placed. On the plan of the village of Enterprise that accompanied Walling's Map of the Counties of Frontenac, Lennox and Addington, Kingston, 1860, both a Saw Mill and the house of A. Jackson are shown on the east side of the street at the southern end of the village. At the same place, the Historical Atlas of 1878 shows "Dophking & Parks Sawmill". The sawmill continued in operation until recent years; much of its machinery remains in the wreckage resulting from a flood that destroyed both dam and mill.

#### 10. Centreville

As early as 1846, the Rev. I.N.D. West, of the Methodist Episcopal Napanee Circuit, wrote (Feb. 9th): "The brethren in Camden have resolved to build a Church. One hundred and thirty pounds have been subscribed". And again, (July 16th, 1846): "We have a deed for a lot of land in



Camden for the purpose of a burying ground, and erecting a Church upon it, and we have nearly means enough to build the house".

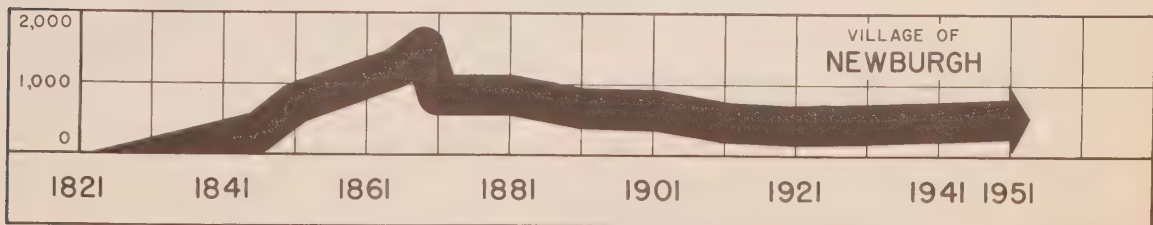
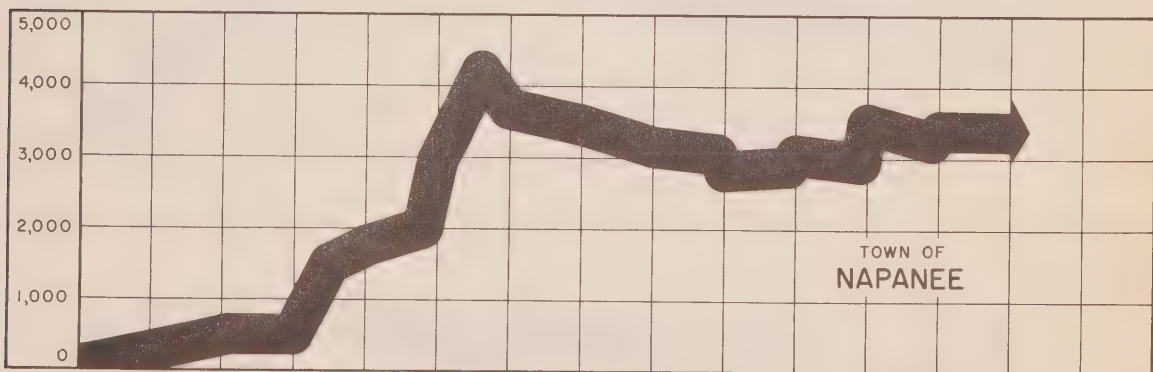
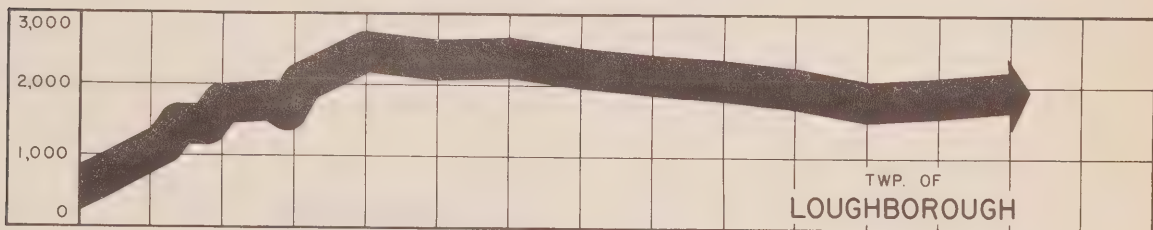
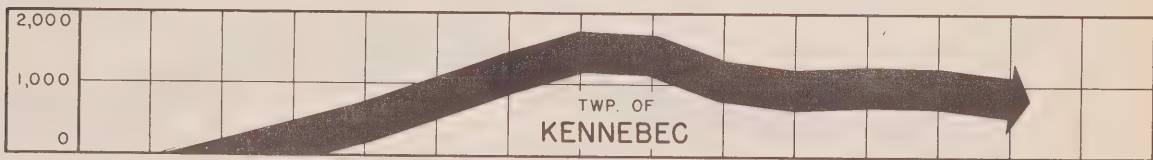
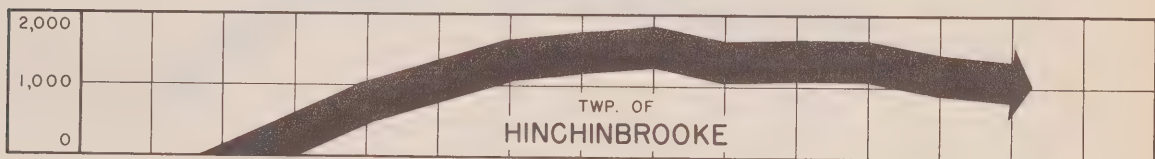
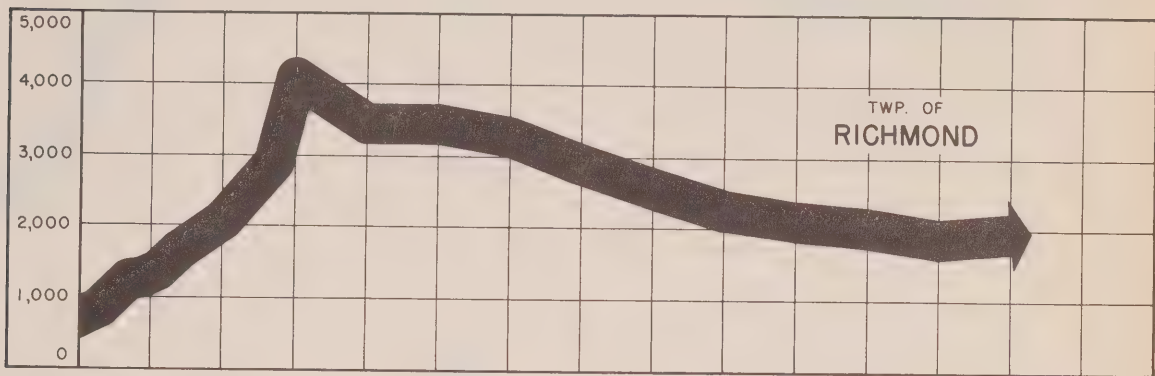
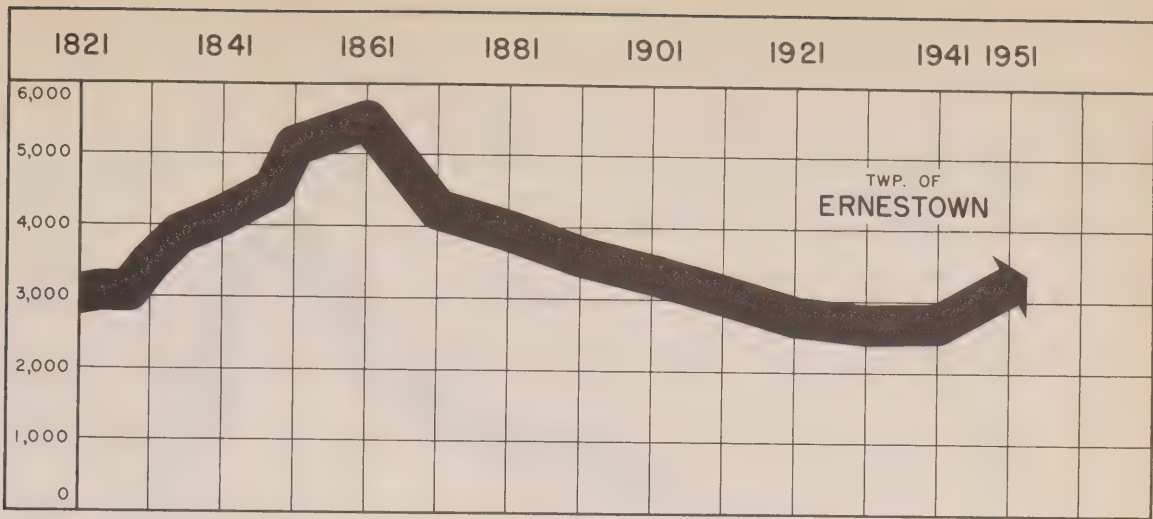
A circumstance to which Mr. West does not refer is the fact that the Wesleyan Methodist body had already, in 1845, built a Church in "Camden", so that by the time the Methodist Episcopal brethren were ready to build their church, they were some two years later than their Wesleyan rivals.

The first settlement in this vicinity was made in 1815, by John Milligan, John Rombough, John Whelan, and Jehial Hawley. The village plot was laid out in 1847, by William Rombough, for the proprietors, James F. Hawley and John Whelan; and for many years the community went by the name of Whelan's Corners. The post office was established in 1849, when the name was changed to Centreville, a reminder of its central position in the township.

In 1865, the village contained four stores, several "workshops", two schools, and three churches - the two Methodist churches and one Roman Catholic. The original Catholic Church was a frame structure, but by 1865 this had been replaced by the large stone church that still stands about a mile south of the village.

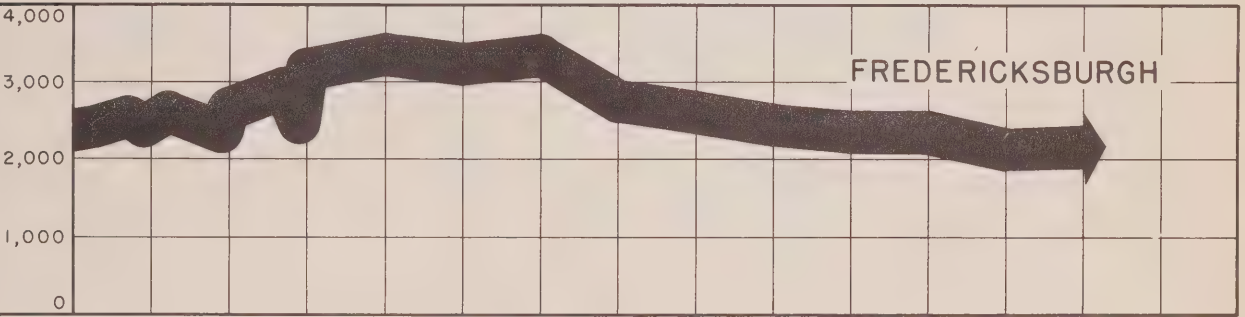
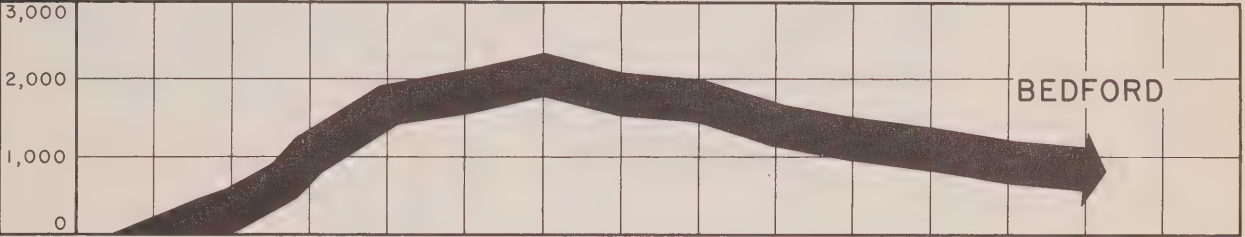
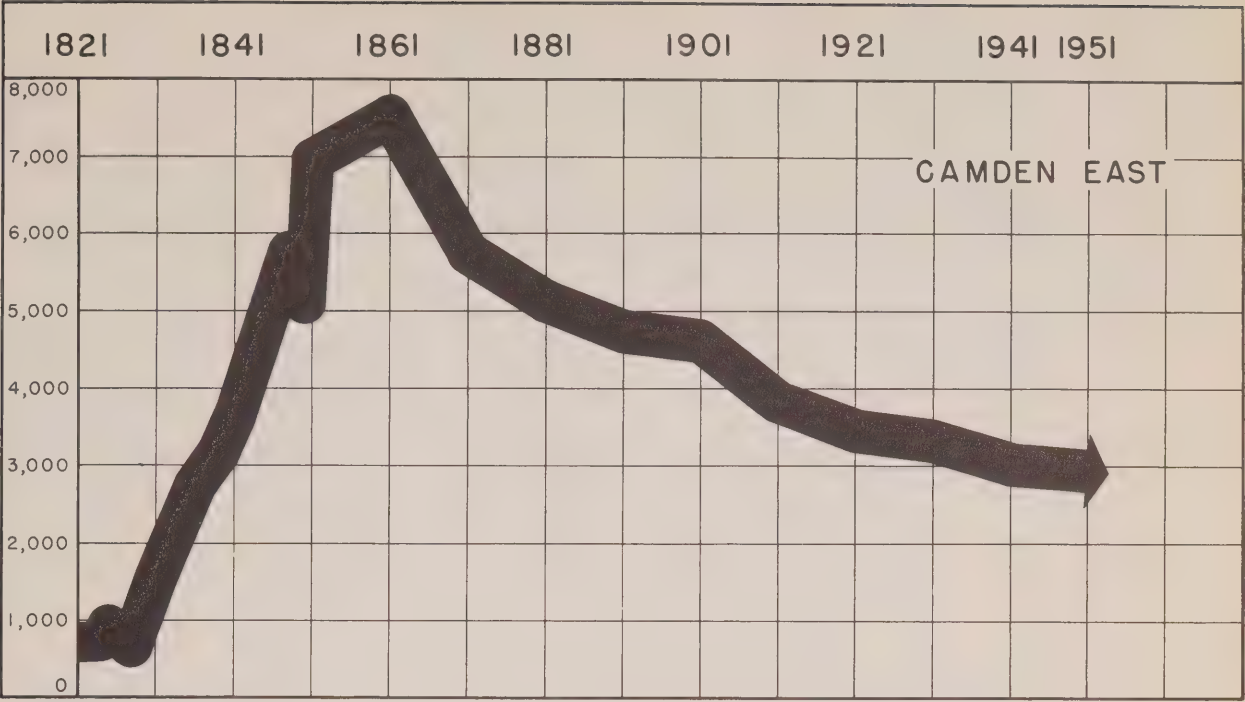
Centreville reached the peak of its prosperity about the year 1870, and thereafter began to decline. Fires destroyed three hotels in the village, people moved away, the churches dwindled, and the parsonages were vacated. One notable fact had always been the lack of water power. Centreville became the shopping centre for the agricultural community round about, and the home of a cheese factory which, since 1870, has served that community.



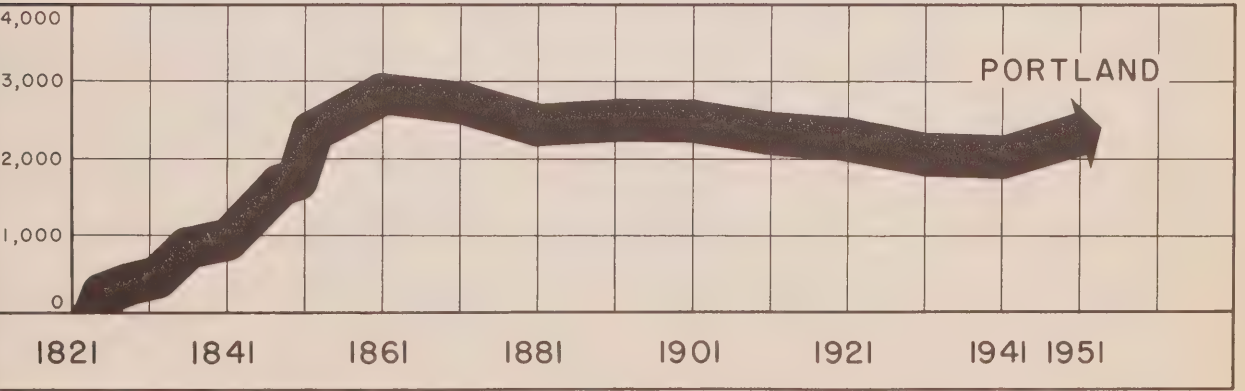


POPULATION





DIVIDED INTO NORTH AND SOUTH FREDERICKSBURGH IN 1858



TOWNSHIP POPULATION



**LAND**



## CHAPTER 1

### GEOGRAPHIC ASPECTS

#### 1. Introduction

The watershed of the Napanee River extends north-easterly from the Bay of Quinte a distance of some 36 miles. The drainage area is somewhat like a funnel in shape, with the small end opening into the bay. At its broadest the valley is about 21 miles wide and at Napanee near the outlet about 2 miles. The area drained by the river is some 202,000 acres, or approximately 315.6 square miles.

Politically the watershed is more or less bisected into an eastern and western portion by the Frontenac and Lennox and Addington county line. It contains portions of 10 townships: Kennebec, Hinchinbrooke, Portland, Bedford, Loughborough, Sheffield, Camden East, Ernestown, Richmond and North Fredericksburgh. There is one town (Napanee), one village (Newburgh), and various smaller communities, including Yarker, Camden East, Verona, Enterprise, Moscow, Strathcona, Bellrock and Centreville. All of these centres are located in the southern half of the watershed where almost all of the agricultural land is found.

#### 2. Hydrography

The Napanee River begins upstream in the Cameron Swamp (Verona Bog) which is fed by a number of headwater tributary streams including Carmen Creek, Whiteman Creek, Depot Creek and Hardwood Creek.\* Each of these streams drains and runs through a chain of lakes, some of which are up to 80 feet or more deep. In some cases the latter are a fair size. The Depot Creek drains, for instance, the First,

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\* The names of lakes and streams used in this report are taken from the 1:50,000 topographic sheets prepared by the Canadian Army Survey Establishment. They may, at times, differ from names used locally.





MUNICIPALITIES

SCALE 1 1/2 0 2 3 4 5 MILES



Second, Third, Fourth and Fifth Depot Lakes, as well as a number of smaller ones.

The two largest lakes on the watershed are to be found on the limestone plain between Yarker and Enterprise. Camden (Mud) Lake is the larger of the two and embraces about 900 acres of area. Varty Lake is approximately 750 acres in size. Both lakes are shallow and rather weedy.

The Napanee River drops about 200 feet between Cameron Bog and Napanee and its passage is marked by numerous falls and rapids. The falls at Yarker, Newburgh and Napanee are significant and spectacular and early in the period of settlement gave rise to grist and other mills. Below Napanee the river has more the appearance of an estuary and is navigable by commercial vessels of small size.

Numerous small tributaries enter the river below Cameron Bog but most, if not all, flow only intermittently. In the spring of the year they are quite active and many cascade down the valley slopes into the river.

The sediment load of the river is low, partly because of the numerous natural settling basins and partly because so much of the watershed is permanently covered by grass and forest growth. The river water itself has a rusty hue due, it would seem, to the mineralogy of the bedrocks and to the Cameron Swamp.

The stream pattern in the watershed has been influenced greatly by the surface disposition and structure of the bedrocks. The deranged pattern found in the northern portion is typical of the Shield and is due to the comparatively recent glaciation. In the limestone area the river flows through an old pre-glacial spillway, the trend of which is apparently conditioned by lines of weakness in the bedrock. A number of other streams in the area (e.g., Salmon River, Millhaven Creek, Blessington Creek) follow the same trend.

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*The sedimentary rocks are usually level-bedded and often outcrop in prominent minor cliffs. The shale layers are less resistant to weathering than the limestone.*



*In a few places the limestone strata have a dip substantially away from the horizontal.*



### 3. Bedrocks

Basically the watershed contains bedrocks of two major types. To the north of the Cameron Swamp are found the granites, gneisses, schists and crystalline limestones of the Precambrian Shield, and to the south of it the more recent sedimentary limestones and shales of Ordovician age.

The rocks of the Shield represent the remnants of an old land mass which has been warped and eroded for many millenia. More recently these rocks have been subject to scouring and grinding by the great continental ice sheets. In this northern portion of the watershed the ice action on these hard rocks created a landscape where barren rock knobs intermingle with hollows filled by fluvial or morainic sands and gravels, by water, or by peat and muck where former ponds have filled with vegetation. The aspect generally is a bleak one from the point of view of agriculture but it holds great charm for the vacationer, principally because of the many lakes. Even where cultivable land exists in sufficient acreage to support a farm or two the soils often tend to be acidic and deficient in fertility.

The agriculturally fertile section of the valley lies to the south of the Shield but even here development is spotty because of ice scouring of the level-bedded Ordovician rocks. Where the bedrocks are more thickly covered by soil materials satisfactory crop production may be achieved. A large proportion of the thin soil area is devoted to permanent unimproved pasture.

These sedimentary rocks, consisting of limestone, shale and some sandstone and conglomerate, were laid down over the Precambrian rocks during Paleozoic time. Geologists have separated these rocks into formations according to age and characteristics. The southern section of the valley is underlain by the Trenton limestones and beneath these are the Black River group. Superficially both are much alike.





**BEDROCK GEOLOGY**

**LEGEND**

**PALEOZOIC**

**ORDOVICIAN**

- |    |                       |   |
|----|-----------------------|---|
|    | TRENTON FORMATION     | MEDIUM GRAINED LIMESTONE; SHALY INTERBEDS                                     |
| \\ | BLACK RIVER FORMATION | FINE GRAINED; DARK BROWNISH GRAY CALCIUM AND MAGNESIUM LIMESTONES; SOME SHALE |

**ORDOVICIAN OR CAMBRIAN**

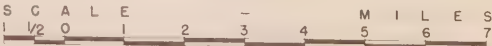
- |  |                  |   |
|--|------------------|---|
|  | POTSDAM (NEPEAN) | MASSIVE SANDSTONE; BROWN AND BANDED RED AND WHITE; OFTEN WITH BASAL CONGLOMERATE OF QUARTZITE AND LIMESTONE |
|--|------------------|---|

**PRECAMBRIAN**

- |    |                            |   |
|----|----------------------------|---|
| \\ | GRANITE AND GNEISS COMPLEX | VARIOUS PINK AND GRAY ROCKS OFTEN MINERALIZED |
| \\ | OLDER BASIC INTRUSIVES     | DARK COLOURED ROCKS                           |

**SEDIMENTS (GRENVILLE SERIES)**

- |     |                                     |   |
|-----|-------------------------------------|---|
| +++ | CRYSTALLINE LIMESTONES              | COARSE TEXTURED; WHITE AND GRAY; SOMETIMES MINERALIZED                |
| \\  | GREYWACKE AND QUARTZITE; PARAGNEISS | METAMORPHOSED SANDY SEDIMENTS; OFTEN CALCAREOUS; SOMETIMES SHALY BEDS |
| \\  | COMPLEX OF GRENVILLE SEDIMENTS      |   |





Once reaching further north, these sedimentary strata have been eroded away to expose the Precambrian beds they formerly covered. The junction between the Shield and the limestones is frequently marked by a cliff of varying height to which the name Black River Cuesta has been applied. Extensive swamps and poorly drained areas, such as those flanking Cameron Creek, are common along the line of contact between the Shield and the sedimentary rocks. Beyond the main sedimentary mass may be found residual hills of limestone such as Basswood Hill. These mesa-like structures will eventually disappear as the erosion cycle progresses.

Although unproductive for agriculture the bed-rocks of the watershed have had a varying economic importance. The sedimentary rocks were useful in the past in the manufacture of cement and from early settlement days the limestones have been utilized for building purposes. Building stone is not taken too frequently now but the many stone houses, mills and other buildings lend a charm to the landscape which is missing where more conventional materials are used.

The bedrocks of the Shield have been economically productive in many ways. Throughout the area one may find abandoned mines where zinc, mica and other minerals have been quarried. Certain rocks are still being quarried in the Verona area for the manufacture of poultry, roofing and other grits.

#### 4. Climate

Climatological data are unavailable specifically for the Napanee Watershed. The nearest weather recording stations are located at Belleville, Kingston and Tweed. An examination of these statistics sheds some light on the general climatic picture of the valley. It would seem that local topographic and other conditions influence the local climatic regime to some extent. The following statistics cover the three stations mentioned above.

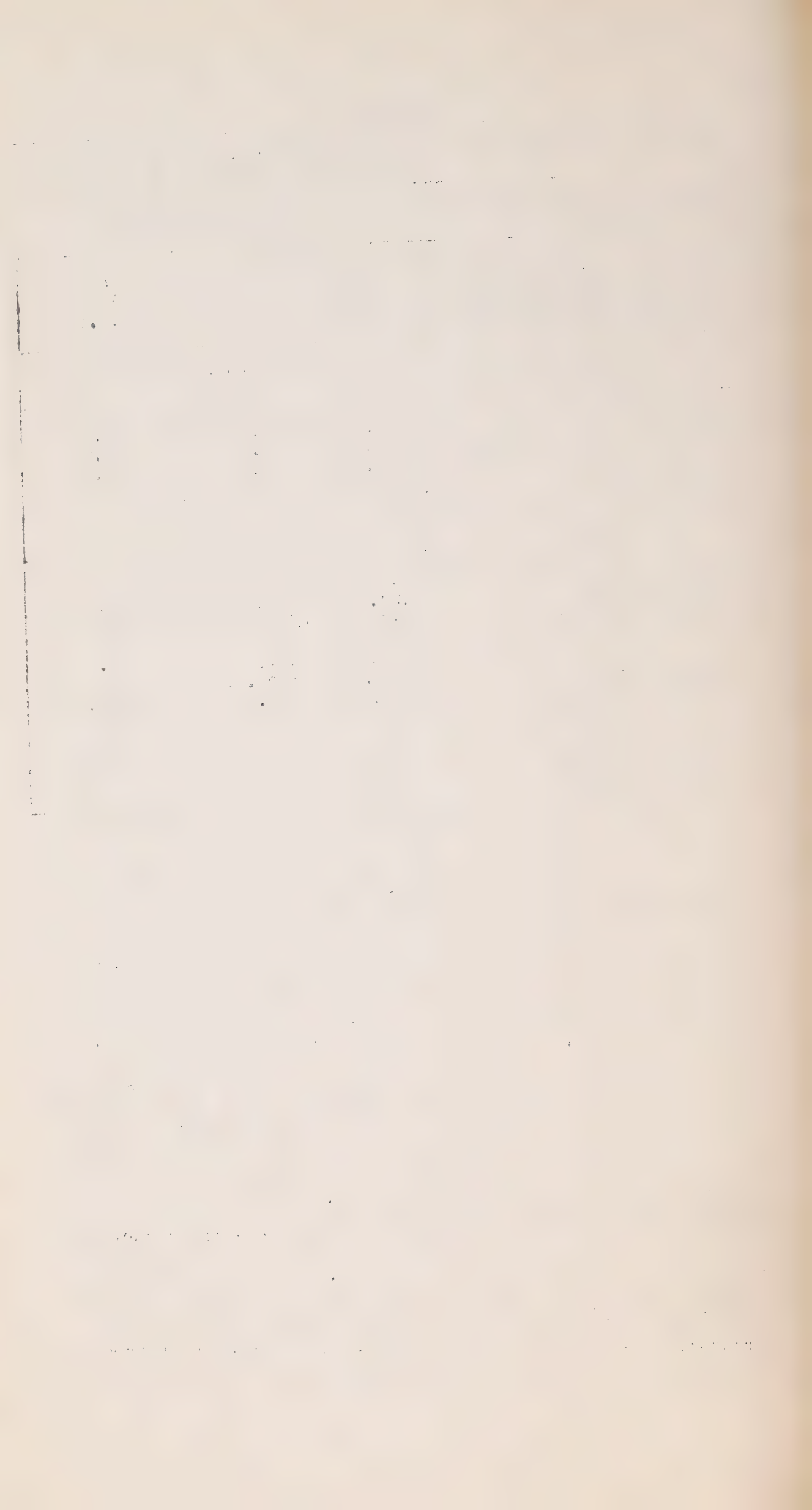


TABLE 1

	Belleville	Kingston	Tweed
Temperature	Degrees Fahrenheit		
Average Daily Maximum	53	52	54
Average Daily Minimum	35	36	33
Average Daily Mean	44	44	43.5
Precipitation	Inches		
Average Annual	31.17	32.82	34.5
" " Snowfall	61.9	62.4	68.1
Summer Rain	8.03	8.51	8.16
Season	Days		
Spring (Last Frost)	June 1	May 27	May 24
(Earliest)	Apr. 17	Apr. 11	Apr. 23
(Average)	May 10	May 3	May 12
Fall (Last Frost)	Oct. 24	Nov. 3	Oct. 13
(Earliest)	Sept. 19	Sept. 11	Sept. 11
(Average)	Oct. 4	Oct. 11	Sept. 27
Frost (Average Free)	147	161	138
(Longest)	179	197	164
Season (Shortest)	121	124	116

As will be noted, there is some distinction between the two southern stations. The lake effect is felt more keenly by Kingston than by Belleville which, though on the Bay of Quinte, is comparatively inland. This is significant particularly as it affects the annual precipitation and frost conditions. In these matters Napanee could be expected to be more like Belleville than Kingston. The Shield portion of the watershed should, logically, resemble Tweed, although these facts have no particular bearing insofar as the sparse agriculture of this area is concerned.

The influence of the climate on crop production may be seen in the case of grain corn. The Ontario Agricultural College has zoned Southern Ontario according to frost-free days, accumulated temperature of the frost-free



period, and corn varieties suitable in each of the zones.\* According to this classification nearly all of the southern half of the Napanee Watershed, i.e., the agricultural portion of the watershed, lies in zone IV and is suitable for this crop although the seeding date is later and more critical than in zones I, II or III, and the safe growing season shorter. The hazards are great enough that grain corn is not recommended for the northern portion of the watershed. Ensilage corn may be grown successfully in this area.

One of the chief climatic hazards on the watershed is that of drought. According to Sanderson the computed amount of water needed for the growth of vegetation in the agricultural portion of the Napanee Valley is of the order of 23-24 inches.† Computed water surplus in the area is about 11.5 inches, water surplus being precipitation in excess of need after the soil moisture has been replenished. It drains away and becomes unavailable to vegetation. Sanderson notes that "A large average water surplus is not beneficial to the soil since it annually removes needed nutrients beyond the range of plant roots. Large surpluses also make farming operations difficult and costly, by keeping the ground muddy and intractable in spring, delaying sowing operations and necessitating drainage. However, a surplus is agriculturally important in recharging ground water supplies and providing water for livestock and irrigation."

The areas in the watershed where water surpluses would be most harmful from the point of view of cultivation would be those agriculturally most productive. These include the Moscow plain, the clay lands along the lower reaches of the river, and the stiffer tills and residual soils on the flat limestone plains. Over a large area soil drainage is

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\* Grain Corn in Ontario, Circ. 253, O.A.C.

† Sanderson, M. Moisture Relationships in Southern Ontario Scientific Agriculture. Vol. 30, No. 6, June 1950.



free and excess water soon percolates away.

When the water need exceeds the supply of moisture in the soil, moisture deficiency or drought occurs. Average annual water deficiency in the Napanee Valley ranges from about 2 inches in the north to about 4 inches in the south. This calculation is based on the assumption that the amount of water in the normal soil available for vegetation is 4 inches.

An assumption that there is a normal soil implies that some are abnormal and can hold either more or less than 4 inches of water. In the Napanee Valley those which can hold less are the critical ones and they include the thin-soil limestone plains where surface run-off may be low but percolation is rapid. Probably chiefly because of this factor these plains suffer severely from drought in a normal summer and the carrying capacity of the pastures is much reduced under their spring-time potential. Many of the sands and coarser tills also probably suffer a greater deficiency than is suggested by the figures for the watershed as a whole. A deficiency of moisture is always harmful to a crop, in reducing the yield and making the plant susceptible to disease. Moisture deficiency, except in those areas where irrigation may be practised, can be expected to reduce crop yields below potential in most, if not all, years.

##### 5. Physiography

In common with a large portion of North America the Napanee Valley has undergone, during the past million years, a series of continental glaciations. According to available evidence there have been at least three glaciations, each being marked by fluctuations. These advances and recessions varied in magnitude in different regions. The ice of the last glaciation, the so-called Wisconsin, left the Napanee Valley under the impress of a warming climate perhaps not much longer than 10,000 years ago. Between each of these



ice ages there were long periods during which the climate was warmer and the land was ice free.

During their passage these ice sheets acted as eroding agents, plucking, quarrying and grinding the bedrock and surface deposits and mounding and spreading the pulverized material. This unstratified, stony material is known as till and the rock materials comprising it were often carried considerable distances from their point of origin. Succeeding ice sheets largely destroyed the work of the one before so that the topography seen in Southern Ontario today is chiefly the work of the Wisconsin ice and of post-glacial drainage. The landforms resulting from the ice action were of several kinds and some of these may be found in the Napanee Valley.

In its movement the ice often spread the till beneath it to form an undulating plain of low relief. Such a sheet is known as a till plain; its slopes are generally smooth but soil drainage may often be a problem. The Moscow, Centreville and Harrowsmith areas may be regarded as till plains although the till in these areas is relatively thin over the underlying bedrock.

Sometimes the till was moulded under the ice into the form of oval hills known as drumlins. Locally these are often known as "whaleback" hills. Over Ontario the dimensions of these hills may vary but they are often up to 75 feet in height,  $\frac{1}{4}$  mile in width, and  $\frac{1}{2}$  a mile or more in length. Usually they are clustered in great fields to form the pleasing and so-called "basket-of-eggs" topography. Drumlin soils are usually loamy, fairly fertile and well drained but steep slopes and the stony nature of the soils may provide some difficulties to cultivation. Good management is necessary to prevent severe sheet erosion of the smooth slopes. In the watershed a number of specimens may be found, chiefly in the lower portion of the Napanee Valley. They are part of a more extensive field found outside the watershed to the west.



*In some places bouldery limestone moraine is best used for rough pasture or forest.*



*In the lower Napanee Valley slumped kame terraces are used for pasture and building materials.*

*Finer outwash deposits near Centreville and in the granite country often provide fair agricultural land and road material.*





During its movement the ice often piled great ridges of till along its border. These ridges, known as till moraines, may be very rough and bouldery and are often unproductive for agriculture because of these factors. Extensive deposits of this kind are lacking in the valley but numerous small moraines may be found here and there throughout the watershed, particularly in the northern portion.

Two major landforms in the valley resulted from the scraping action of the ice on the bedrock. In the north, on the Shield, the ice removed the previous soil cover to form the present rock knob upland. In the south the same thing occurred but the more or less level bedding of the sedimentary strata restricted differential erosion by the ice with the result that a level thin-soil or soil-free plain was formed. In both cases the land was left largely unproductive for most forms of agriculture.

As the climate warmed the ice retreated and poured off vast quantities of melt-waters. These waters, of themselves and from the lakes they formed, were important in the creation of landforms of significance.

The pre-glacial valley of the Napanee River was further eroded by the ice of the glacial period and by the melt-waters pouring off the ice as it retreated. These melt-waters often moved at high speed and were able to carry large amounts of sediment in the form of sand, gravel, clay and silt. The coarser components were often dumped along the edge of the ice into rough hills of stratified sand and gravel. The landform resulting is called kame moraine and many small examples may be found on the watershed particularly in the northern section. Such land is usually rough, droughty and lacking in fertility and is consequently not valued for agriculture. The kame terraces along the slopes of the lower valley are similar. They are valued chiefly as a source of road metal and building materials.



During the period of ice retreat numerous small temporary lakes were formed, particularly in the Shield where the topography lent itself to minor impoundments. These were often filled with sandy materials, and, when drained, left a small sand plain. Where the soil drainage is adequate these areas are useful to agriculture. On some farms such land forms the bulk of the agricultural land although nutrient deficiencies are common.

As the ice retreated from Ontario a succession of great glacial lakes were formed. One of these, Lake Iroquois, occupied the Lake Ontario basin but its waters were much deeper and covered a far larger area than do those of the present lake. In the Belleville and Napanee areas these waters extended far inland from the present shore. Coleman suggests that all of the watershed south of a line drawn between Petworth and Centreville was submerged by Lake Iroquois.\* Some of the clays near Napanee were constructed by the waters of this lake.

## 6. The Physiographic Regions

The multiplicity of land forms on the Napanee Watershed occur in particular combinations which are separable into distinct physiographic regions. These regions are a vital reality in the agricultural and other activities of the residents of the watershed. Although the people may call them by different names, the general location and particular individuality of the regions will be appreciated. Not all of these regions are confined, of course, entirely to the watershed; some extend beyond it.

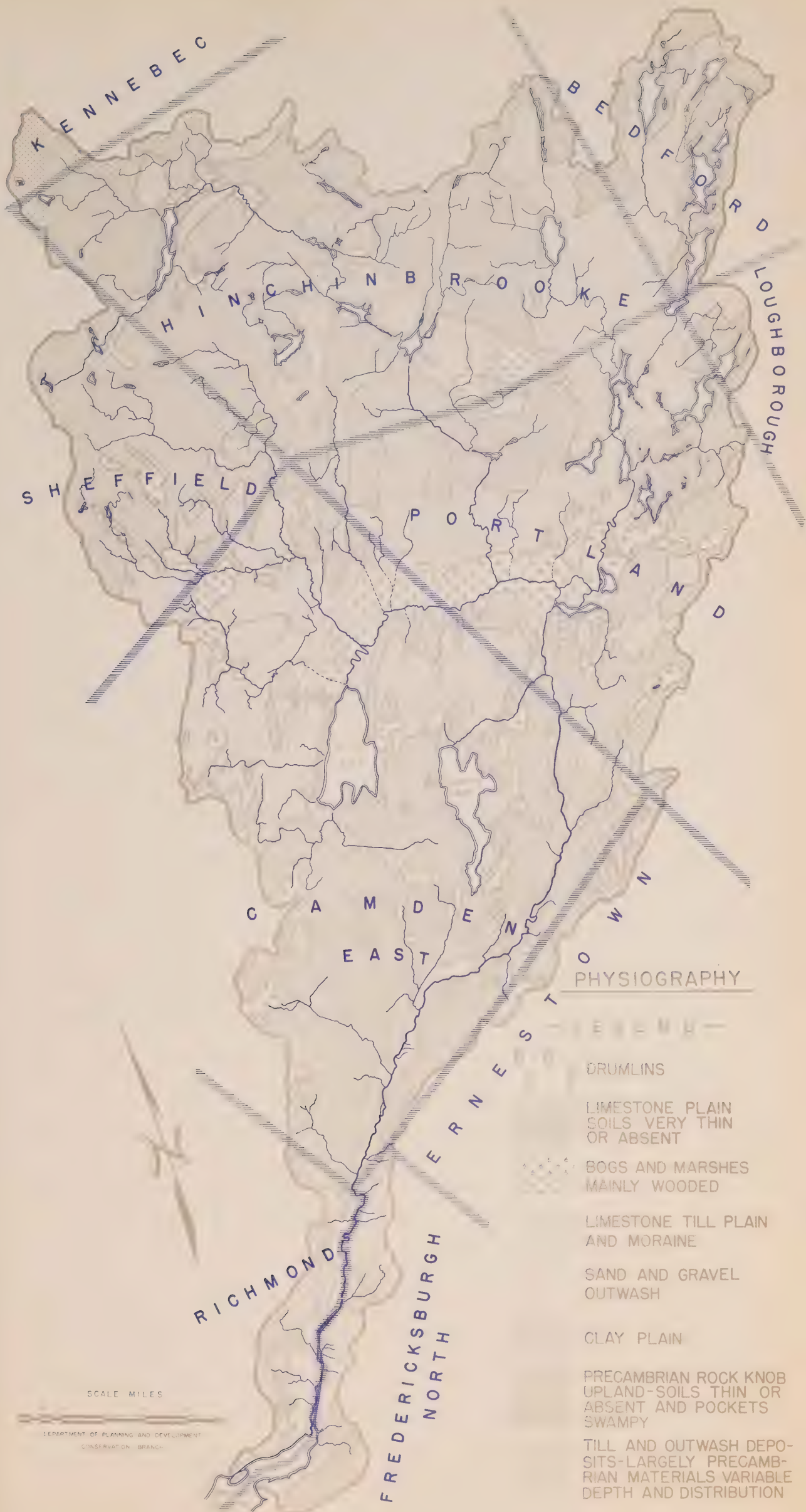
### (a) Rock Knob Uplands

This area lies entirely within the Shield of which it forms a small part. Although termed an upland the

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\* Coleman, A.P. Lake Iroquois. Ontario Dept. Mines. 45th Annual Report. Vol. XLV, Part. VII, 1936. (map)





# PHYSIOGRAPHY

DRUMLINS

LIMESTONE PLAIN  
SOILS VERY THIN OR ABSENT

BOGS AND MARSHES  
MAINLY WOODED

LIMESTONE TILL PLAIN  
AND MORaine

SAND AND GRAVEL  
OUTWASH

CLAY PLAIN

PRECAMBRIAN ROCK KNOB  
UPLAND-SOILS THIN OR  
ABSENT AND POCKETS  
SWAMPY

TILL AND OUTWASH DEPO-  
SITS-LARGELY PRECAMB-  
RIAN MATERIALS VARIABLE  
DEPTH AND DISTRIBUTION

SCALE MILES

DEPARTMENT OF PLANNING AND DEVELOPMENT  
CONSERVATION BRANCH



elevation is, in reality, not great. Nor is the relief, although the country is rugged and bare rocky knobs and lakes and swampy areas are common. The elevation rarely exceeds 700 feet above sea level.

The soils are light, often stony and, except near Bellrock, Verona, Godfrey and Wilkinson where deeper pockets are found, are usually too thin and limited in extent to be useful to agriculture. The future of the area rests chiefly in the exploitation of its present and future forest, its recreational, water and possibly mineral resources. In this region are located the largest tracts of forest land so far acquired by the Napanee Conservation Authority.

(b) Cameron Creek Swamp

This extensive swamp lies in the middle of the watershed between the Shield on the north and the limestones on the south. Undeveloped at the present time, it is the largest in the valley and is dealt with more completely elsewhere in this report.

(c) The Undulating Centreville Plain

This area, lying mainly over limestone bedrock but protruding into the Shield north of Enterprise is a rolling plain of light and medium-textured tills. Kame materials may also be found, and also a few drumlins. Low-lying areas present drainage problems.

In this region of moderately good soils a reasonably prosperous mixed-dairy agriculture has developed. The region extends to the west beyond the watershed boundary. Enterprise is the local centre.

(d) The Moscow Till Plain

The somewhat waterworked till deposits of this area are level and moderately deep. The soils are moderately fertile and although drainage is sometimes a problem in places a good local agriculture based on milk production has been achieved. The cheese factory at Moscow, the small centre for the area, is one of the few remaining in the watershed.



(e) The Limestone Plains

These plains occupy the bulk of the southern portion of the watershed away from the river valley itself. The topography is generally subdued and quite level. Over wide areas the dull-grey, fissured limestone is exposed at the surface or is within a few inches of it. Elsewhere, deeper deposits of drift may be found and a lively agriculture supported. Pasture and trees are the chief crops on the thin-soil land and both are affected in summer by drought due largely to the open nature of the soil and bedrock. The two largest lakes on the watershed, Camden and Varty, occupy extensive shallow depressions in the plain.

(f) Lower Napanee Valley

This portion of the watershed may be considered to occupy a band of varying and indeterminate width along the Napanee River, and to extend from Colebrook to Napanee. On either side of the river the valley rises quite steeply and rock ledges are common. The soil deposits in the valley are variable in depth and kind and include light and medium tills, outwash materials and lake deposits or deposits re-worked by lake water. By and large the river flats are quite narrow but here and there they widen sufficiently to be available for field crops. Dairying is the most important farm occupation but some beef cattle are kept. In the vicinity of Napanee, and at some places upstream, market crops, particularly raspberries, are important.

Through this valley are found the town of Napanee and the villages and hamlets of Strathcona, Newburgh, Camden East, Yarker and Colebrook. A main road and a railway parallel the river and it is from each of these, rather than its physiography, that the region obtains its character.

(g) Napanee Clay Plain

This relatively level clay plain enters the watershed on the south-west. The soils are well to imperfectly drained and are used considerably for the production of





*Bedrock at the surface on the limestone plain. Note the solution cracks along the joint planes.*



*On the limestone plain the soil is often thin and the pasture sparse.*



cash crops.

Each of the regions outlined above has problems in conservation which are found elsewhere in the watershed. At the same time each of these regions has one or more problems which, while not unique, are more peculiar to itself simply because there are differences in soils, availability and quality of agricultural land and so on. In dealing with and managing its watershed the Authority should keep these differences in mind.

## 7. Soils and Soil Erosion

### (a) Introduction

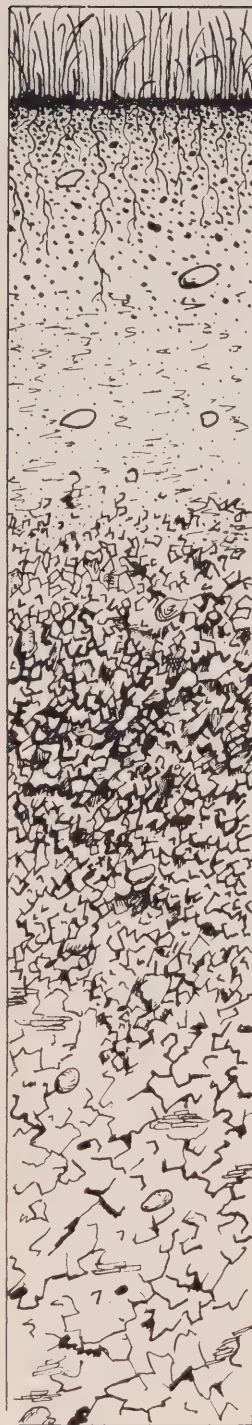
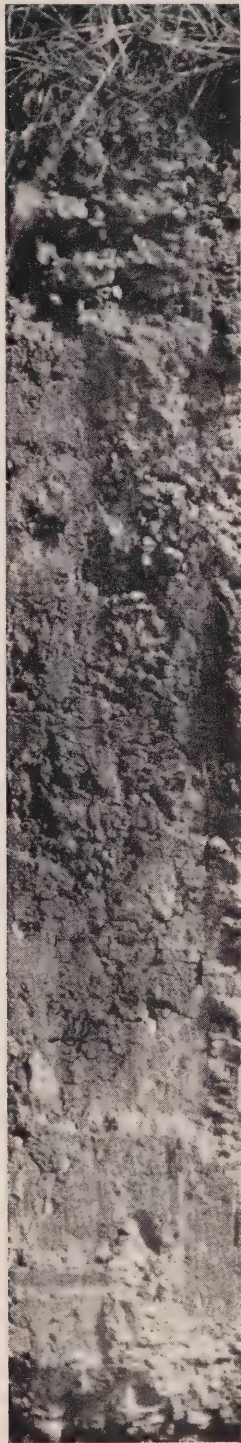
In watersheds where county soils maps are available it has been the practice to use these maps and reports as the basis for watershed mapping and planning. Although many of the counties of Southern Ontario have been reported on, reports have not yet been published for a number of others, Frontenac and Lennox-Addington among them. This being so, the present survey of the Napanee Watershed was carried out in a slightly different way to that usual where maps of the Ontario Soil Survey are available.

Where these maps and reports exist soil conservation survey work is based on the soil type. Where they do not exist, as on the Napanee, the somewhat broader category of parent material type is used. Basically, however, the difference is one of degree rather than kind and the eventual classification of the land according to its capability is the same. In the mapping, those features of the soil such as severity of erosion, slope and drainage are the same regardless of which system is used.

### (b) The Soil Profile

Although soil may be described loosely as being the medium in which most plants grow, even general observation reveals the fact that there is considerable variation in the soil and in its ability to support crops. Not only is there variety in the materials making up the soil but different soils





PRESENT VEGETATION

A1

6" HUMUS BEARING HORIZON

Dark brown, friable loam  
sometimes stony

A2

6"-15" HORIZON OF  
LEACHING, Pale brown or  
greyish, powdery loam  
sometimes stony

B

15"-30" HORIZON OF  
ACCUMULATION, Compact  
nut structured, reddish-  
brown and brown clay loam  
may be stony

C

PARENT MATERIAL, Light  
greyish brown shale and  
limestone till, some stones  
and boulders

*Profile of a representative gray-brown podzolic soil*



of different capability may develop on much the same type of material.

As described, here the soil is a reflection of the environment in which it developed. As a result, the development of any particular soil is a matter which involves a number of factors, some one or group of which may be of more importance than the others. Type and composition of the parent material, surface slope, soil drainage, climate and vegetation are some of these factors. In any single instance they operate together in such a way that, given time, they produce a soil possessing certain recognizable characteristics.

If a vertical cut is made to a depth of three or four feet through the soil it will be seen that the cross-section is marked by a layering, each layer, or HORIZON, possessing certain characteristics of colour, texture, structure, organic content, acid reaction and so on. Together these horizons make up the soil PROFILE. The depth of the profile is variable, in some soils a foot or less and in others several or many feet. In point of time most of the profiles on the Napanee Watershed are shallow and the soils youthful. Over much of the watershed the bedrock is at or very near the surface and there is little or no soil, much less a profile, to speak of.

Throughout Ontario several distinct kinds of profile may be found and each is representative of a great soil group. The well drained Gray-Brown Podzolic soil, of which a generalized profile description follows, is common in Southern Ontario and is represented on the Napanee Watershed.

#### HORIZON

- A<sub>0</sub> - Partially decomposed litter from deciduous trees.
- A<sub>1</sub> - Dark grayish-brown to very dark brown mineralized humus layer - loose and friable and slightly acid in reaction.



- A<sub>2</sub> - The leached horizon, yellowish to yellowish-brown to gray in colour. The iron, lime, organic matter and clay have been washed out and the reaction is acid.
- B - The horizon of accumulation, containing a high proportion of clay and sesqui-oxides. Usually the colour is dark or reddish-brown while the structure is blocky or nutlike. In reaction it is usually neutral to slightly acid but the lower portion of the horizon may contain some free carbonates.
- C - The unweathered, calcareous parent material, usually gray or brownish-gray in colour.

In no case are the horizons separated one from the other by a sharp break; there is always a transition, in some cases greater than in others.

Profile complexity also varies. In some soils not all horizons are represented, or they may be poorly developed. Also, the horizons may vary considerably from soil to soil in thickness; some have a thin A<sub>2</sub>, some have a thick A<sub>2</sub>, and so on.

When speaking of the soil horizons the A is considered to be the topsoil, the B the subsoil and the C the parent material. In a poorly drained soil the A<sub>2</sub> and B horizons may be missing and a G (glei) horizon exhibited, hence the name Dark Gray Gleizolic applied to soils of this kind. The inferior soil drainage is reflected in the dark colour of the soil and the blue or bluey-gray colour and rusty mottling of the glei horizon.

As plant material decays it is gradually incorporated into the A horizon as humus by the action of earthworms, micro-organisms and so on. During this process certain acids are formed and these are washed downwards by the rain. Partly as a result of this acidic solution, lime, iron, clay colloids, and organic matter are leached out and carried



downward to be redeposited, in part, in the B horizon. The B horizon thus has a rather high clay content and is dark-brown to reddish-brown in colour. Depending on their thickness several horizons may be mixed together when cultivated to form an A<sub>c</sub> (cultivated) horizon.

Under conditions of a fluctuating water-table near the surface a soil may be considered to be imperfectly drained. Such a soil may possess a thicker A<sub>1</sub> horizon and at the same time the A<sub>2</sub> or leached horizon may be less well developed. Field identification is guided by mottling (rusty streaks and patches) appearing in the lower part of the A<sub>2</sub>, and in the B. horizons.

In addition, there are on the watershed several other kinds of soil which reflect local environmental conditions. In the case of organic soils (muck and peat) the drainage has been so poor for so long that normal profile development has been unable to take place. The poor drainage conditions have prevented the complete decomposition of the plant residues with the result that they have accumulated over the years. The persistence of water inhibits the activity of aerobic bacteria, earthworms and fungi.

Many peat deposits are found in low-lying areas which obviously were pondings at one time but which have since filled in. Shallow lakes such as Varty and Camden are undergoing a similar filling process at the present time.

Probably most of the peats are derived from a forest or semi-forest cover and are consequently woody. Often however, these deposits contain thin layers of peat derived from carex, cattail and marsh grass remains. Sphagnum and hypnum deposits do not appear to be important. The peat is highly variable in depth, ranging from a foot or so to over 20 feet.

Except for small areas in existing fields the organic soils of the watershed have remained unused for agricultural purposes. In at least one area, the Cameron Bog,



it is believed the peat soil is capable of more intensive use than presently exists.

Bottomland, a land type consisting of soils made up of alluvium, is found along the stream courses where periodic inundation takes place. This flooding leads to the deposition of various mixtures of sand, silt, clay and gravel. Soil drainage is usually imperfect to poor and soil profile development is most often non-existent. Except in a few places along the Napanee River these lands are so limited in extent that it is not normally feasible to use them for crop production and they are either left in forest or cleared for rough pasture. Soil fertility is highly variable and ranges from poor to good.

Over wide areas of the watershed the bedrock is so near the surface that normal soil development has been unable to take place. In many cases, particularly on the limestone plain, the present soil cover must be considered residual and a direct product resulting from bedrock weathering.

(c) Soil Erosion

Many people are possessed of the misconception that erosion of the land, that is, the translocation of soil materials from place to place by the natural forms of wind or water, can be stopped completely. This is impossible, except, perhaps, over small areas, for relatively short periods of time, and under certain conditions. Through the ages erosion of the land has taken place, moulding it into the scenery we see today. Under natural conditions this erosion is a very slow process and long years are required to alter the landscape appreciably. We call this form of erosion "geologic" erosion.

Under natural conditions the face of the earth is masked by a cover of vegetation and it is this cover which is chiefly instrumental in retarding run-off and slowing down erosion by wind and water. Because of the slow



rate of erosion the soil, as seen in the profile, is not greatly affected by it and the process of soil building is easily able to keep pace with it. While conditions remain more or less the same the loss of a fragment of surface soil is offset by an increment from below as the parent material weathers and is incorporated into the soil. Under conditions such as this nature is, by and large, in balance.

When the land is cleared for cultivation or used for grazing, however, this picture may be greatly changed: the protecting cover of vegetation is removed or reduced; cultivation may be carried on up and down the slope and surface water enabled to flow over the land more easily; the structure of the soil changed for the worse and organic content lessened with the result that the soil's moisture absorptive capacity is impaired. All of these changes can easily produce, in a rather short time, a less productive or even a ruined soil.

Such erosion is called induced or "accelerated" erosion. It is this erosion that the conservationist is concerned about and which every farmer should be aware of.

Some soils erode more readily than others and the same soils under different forms of land use may show vastly different amounts of erosion. There are also other factors which affect the rate of erosion: surface slope, topography, intensity of land use, rate of rainfall and the physical condition of the soil. For these and other reasons a farm plan based on conditions peculiar to the individual farm is desirable to control erosion.

In Ontario the removal of soil by erosion is accomplished by wind and water; the former is of importance in only a few areas, chiefly those of light soils. Erosion by water is much more widespread although, as intimated, it is more damaging on some soils than on others.



When the surface run-off is concentrated into channels which are unprotected, or inadequately protected, gullies may develop. This is the most spectacular form of erosion in Ontario and a gully can grow quickly to the detriment of the land and the farmer. Fortunately, this form of erosion is not common on the present watershed but some gullies are found cutting back through streambanks. Run-off channelled in an unprotected field, unprotected tile drain outlets, and channels formed through cattle always using the same path are among the contributing factors leading to gully erosion.

At the start a gully may be insignificant but it can become large very rapidly. Small rills which are found on the slope of a cultivated field after a heavy rain and which can be covered over at the first cultivation are danger signals every farmer should heed.

Sheet erosion is much less spectacular but is dangerous because it is so widespread and most often goes unnoticed. This form of erosion usually takes place relatively slowly, but a whole field may be affected, with the result that the humus-rich portion of the soil, together with its store of available nutrients, is removed. Much of this erosion takes place during summer storms, just at a time when crops need the moisture which is flowing over the surface of the land into the streams. A reduction in the run-off would thus prove directly useful in at least two ways: reduced erosion and increased moisture supply for crops.

Many measures may be adopted to control run-off and reduce erosion. Land kept under a permanent cover of grass or trees and properly managed may erode very little. The same may be true on level lands regardless of the form of use, although, of course, the land may become less productive unless soil management practices are adequate. Soil-building rotations, the use of cover crops and fertilizers, contour tillage and grassed waterways are among the measures that may be used.



(d) The Estimation of Erosion

There are a number of ways of determining whether erosion has taken place and the amount. The effect of erosion may often be easily seen in poor crop response due to drought. On slopes or knolls where the A and/or B horizons have been removed, the soil is less able to absorb moisture, and the crop may be thin and weak. Where erosion has been severe, the grayish parent material may be seen at the surface. A patch with an excessively stony surface may also be a sign of severe erosion and reflect the removal of the finer soil constituents. Erosion of this severity is relatively rare on the watershed.

Where observations such as this may be made, other evidence is also usually available; sediment may be seen to have accumulated at the bottom of a slope; soil may accumulate on the uphill side of a fencerow, while the downhill side is cut away.

To get a more certain determination of the degree of erosion the soil profile must be examined. It is usually possible to find a good profile of a virgin or nearly undisturbed soil in woodlots and along old fencerows. Such a profile may, for instance, exhibit one foot of topsoil ( $A_1$  and  $A_2$ ) and two feet of subsoil (B). On an adjacent cultivated slope of the same soil type and on which erosion is suspected, there may be only 6 inches of topsoil over the subsoil. In such a case it would be fair to assume that something like 6 inches of topsoil had been eroded away. In another case one might find the sub-soil exposed at the surface and the parent material at a depth of only 12 inches. All of the topsoil and one half of the sub-soil, something like 2 feet of material, would thus have been removed.

If the recognition of horizons by colour or texture is difficult, a simple chemical test can be used to aid in erosion estimation. A dilute solution of hydrochloric acid produces an effervescence when applied to soil containing



free carbonates. In the imaginary virgin profile mentioned above a fizz would be obtained at 3 feet at the start of the lime-rich parent material. On the severely eroded site the same result would be obtained at 1 foot. If the surface soil effervesced it would indicate that all of the topsoil and sub-soil had been removed. A note of caution should be made, however, in that some soils may be found where other horizons naturally possess sufficient free carbonates to produce a reaction.

(e) Soil Erosion on the Watershed

Generally speaking the agricultural lands of the watershed have suffered from erosion in only a minor way. Part of the reason lies in the fact that a large portion of the cultivable land is level to gently sloping. Erosion is more severe where the slopes are greater, as, for instance, on some of the valley lands adjacent to the Napanee River.

The bulk of the cleared land is devoted to pasture and hay and these are normally excellent erosion control crops. Over wide areas pasture is the only possible crop, apart from trees, and the question is simply one of restricting over-grazing. It is a difficult point to prove but it is believed that some of the thin soils on the limestone plain have suffered severely from past mismanagement. In the northern part of the watershed erosion resulting from agricultural mismanagement is slight but fire, and perhaps grazing, have no doubt damaged the soil cover and hindered forest regrowth.

In addition to removal of the soil by wind and water there is also the question of lost soil fertility. Where this loss takes place it is the result of one or more of three things. Part of the loss, and a considerable part at that, may result from soil erosion. In large measure it may be overcome through the application of wise land use practices. Nutrient loss may also take place through leaching which, though a natural process, is speeded up by improper husbandry and the



depletion of the soil organic content. Substantial nutrient loss also takes place through their removal in crops and animal products. Where milk, beef, grains and other products are being sold off the farm nutrient depletion of the soil may be very high. This loss may be overcome to a considerable extent by the application of commercial fertilizer.

Not all soils have the same inherent fertility, nor do they possess the same resistance to continued cropping. The measurement of fertility depletion is difficult in a field survey and perhaps the best record is to be found in the individual returns for each farm. Individual farmers will know the productivity trend of their land. In most cases it is capable of substantial improvement.



## CHAPTER 2

### PRESENT LAND USE

#### 1. Past Patterns

Self-sufficiency was a prominent characteristic of pioneer agriculture in Southern Ontario. The essential requirements of life were produced, as far as possible, on the farm. Transportation facilities were often poor and goods carried long distances were costly.

Almost from the beginning, however, some type of cash crop was produced to obtain capital for future development and acquire those few goods and services that could not be provided on the pioneer holding. Lumber and potash were among the first "cash crops" of the pioneer. He exploited the accumulated resources of nature to carry him over until his land began to produce agricultural commodities.

Wheat and rye were two of the earliest cereal crops in the area of the Napanee. The emphasis was on spring rather than fall wheat, but today the pattern is completely reversed. In pioneer days much of the wheat was ground into flour and used locally. Rye, on the other hand, was largely a cash crop and much of the grain was sold for whisky manufacturing.

With an increase in numbers of livestock, hay and oats multiplied in acreage. Timothy hay was a prominent cash crop in the heyday of lumbering, since a large number of horses were used in the operations. The Napanee Watershed like many other areas in Ontario, benefited from this market. In later years clover and alfalfa have largely replaced grass as a hay crop. Alfalfa became common in the Mud Lake area about 40 years ago.

Several crops, which now occupy an insignificant acreage or are not grown at all, once enjoyed considerable popularity. Field corn was prominent in the 1870's and



almost every farm had a few acres of this row crop, which was used for stock feeding. The decreasing labour supply contributed greatly to the decline of corn.

Flax was popular in pioneer days and extensively grown in the Moscow district. For a time, some was processed into cloth locally. Later, considerable quantities were sold for seed. Today this crop has almost entirely disappeared from the watershed. The same is true for hops.

Barley once held a prominent position in the agricultural economy of the area. Public demand for pale ale in the United States created a stimulus for barley production that lasted for about 50 years. The acreage in barley increased rapidly during the 1860's and 1870's and remained strong during the first decade of this century. In the early days of the barley era the grain was selling as low as 40¢ to 50¢ a bushel, but in later years reached a high of \$1.50 a bushel. The coming of prohibition and stiff American tariffs brought about the decline of this grain as a cash crop, and today barley is mainly sown as a mixed grain with oats and used as a livestock feed.

Field peas were once extensively grown in the watershed and rivalled wheat in acreage sown. At the turn of the century this crop began to decline rapidly to an insignificant position. The recent introduction of canning crops, mainly in the southern section of the watershed, has brought about a minor revival in pea production.

Livestock have played an important role in the farm economy of the watershed from very early times to the present. Sheep were very important until the middle of the nineteenth century but have since undergone a steady decline in numbers. The decline in sheep production is attributable to a number of factors. The carrying capacity of the limestone plains may have decreased seriously as a result of over-pasturing. Dogs and wolves were also a menace to the stock in some areas. For many farmers, the complete



switch to dairy cattle proved more profitable and more enjoyable.

Hog production has always been important in the area, but a decline set in from the high production of the mid-nineteenth century. During the war years production increased considerably, as it did over most of Southern Ontario, but the post-war period showed another drop in production.

Cattle breed preferences have changed considerably throughout the years. In the Moscow district the Ayrshire breed was favoured in early times. Durham cattle soon gained the ascendancy. With the development of cheese factories about seventy or eighty years ago, the demand for fluid milk increased. The cattle population rose quickly and the Holstein breed largely replaced Durhams. In the Moscow region Holstein cattle became very popular about 30 years ago.

## 2. Present-day Agriculture

In terms of the present agriculture, the watershed may be divided into two broad areas. These conform roughly to the two major geological areas. Conditions on the granite rocks of the Shield in the north stand in sharp contrast to those existing over most of the more southerly limestone area.

### (a) Precambrian Shield Agriculture

Agriculture on the Shield is confined largely to scattered pockets of deeper drift along the roads. The farm population is sparse and as scattered as the farm land. Relative isolation, even with the lack of many amenities, is welcomed by many of the rural folk and imposed on others. Most of the farms are owned but many homesteads have been abandoned.

Considering the low population the roads are kept in a satisfactory state of repair. The road net is





*Sparse and rocky pastures are typical of the Shield.*



*Only a small acreage of cultivable land exists among the granite rocks of the northern portion.*



highly incomplete however and large areas are inaccessible for vehicular traffic. There is little doubt that municipal income from summer properties contributes greatly toward keeping some roads open and in good repair.

The total acreage of improved land is rather small and field crops occupy only a small fraction of this land. The great bulk of the land is too rocky, stony, wet or shallow to support a substantial agriculture although a large portion of it is used as range for cattle. There is considerable doubt that the income per acre from this form of use is as great as would be derived from a managed and protected woodland.

The main emphasis on the Shield is the production of livestock or their products. Beef and dairy cattle provide the chief source of agricultural income and are about equal in this respect. Beef production is more important in those areas where road access is poorer and the land must be considered as range rather than pasture. Swine and poultry are an important secondary source of income. Milk is shipped to Parham, Selby and Harrowsmith. It is reported that one producer ships whole milk to Toronto.

Wheat, barley, oats and potatoes are the main crops grown. Most of the pasture is unimproved and much of the hay is wild hay gathered from wet, low-lying areas.. There would appear to be greater opportunity for potato production on some of the larger, light till and sandy areas.

(b) The Limestone Area

The southern section of the watershed is more completely agricultural and the economy depends largely on livestock production and dairying. Although farm tenancy exists the land is predominantly occupied and farmed by owners. Where the soils are thin many farmsteads have been abandoned. This fact serves to indicate the low productivity of the land.





*Some of the better land in the watershed is found on the Moscow plain.*



*Cattle underpasses like this are common in the limestone country.*



The increasing industrial development in Napane and Kingston has opened up jobs attractive to many residents in the Napanee Valley, some of them farmers. There would appear to be an increasing tendency for some farmers to gain a high proportion of their income from non-farming activities. If this situation continues, and there is every reason to believe that it will, there will probably be a decreasing interest in those crops requiring a high labour input and an increasing interest in those crops requiring a minimum of labour.

In the southern portion of the valley, and along the Newburgh Road, cash crops, particularly raspberries, are produced on small holdings. Agricultural enterprise of this kind may be expected to develop.

Field crops occupy a high percentage of the land and, as on the Shield, the production is chiefly of livestock feeds and fodder. Only a very small acreage is devoted to commercial grain crops such as wheat and rye. Oats and mixed grains occupy a much larger acreage. By far the bulk of the improved land is devoted to hay and pasture; much of the latter is found on the thin-soil limestone plain and is unimproved and often incapable of much improvement because of physical land conditions.

Canning crops, chiefly corn, peas and tomatoes, and market garden crops have become more important in the last few years. The bulk of the canning crop is processed by Canadian Cannery in Napanee, but some production also goes to the plant at Deseronto. The volume of production coming from the valley is small however, chiefly because most of the land suited to these crops lies beyond the confines of the watershed.

Dairy production is probably the mainstay of agriculture in the watershed and the milk finds several uses. Cheese factories at Tamworth, Selby, Newburgh, Moscow and





*Cheese factory at Moscow.*



*Grass being cut for silage on the till plain near Hartington using modern equipment.*



*Grass from the carrier being blown into the silo.*



Harrowsmith take a considerable volume of milk, as do dairies and creameries at Parham and Napanee. Skim milk powder is produced at Newburgh. Whole milk is also shipped to Napanee, Toronto and Kingston. The Acme Farmers Dairy condensery at Napanee takes a considerable volume.

As elsewhere in Ontario swine are an important source of revenue but production varies considerably with the market demand. A fair number of sheep are kept in both sections of the valley but generally speaking their importance is minor.

Poultry and egg production have been important in the valley for some time although there are few large producers. Live poultry shipments to the United States have been important at various times but the Canada Packers plant at Napanee probably absorbs the largest single part of the production. The largest concentration of birds is found in the Moscow area but the Lens - Centreville - Enterprise area is also important.

### 3. Regional Orientation

Although the valley is a hydrographic unit it is much less than that in terms of economic and social unity. This is true to some extent of all watersheds of course, but it is more true of the Napanee than of many where Conservation Authorities have been established. This fact should be recognized by the Authority and steps taken to create a public interest in the river and the lands which it drains.

Several factors are responsible for the diversion of interest away from the valley. The lack of a major flood problem on the river has not created a local interest in river problems which a recurring event such as this would do. The contrary phenomenon of low summer flow has resulted in much local attention, particularly in the lower portion of the valley.



The fact that such a large portion of the valley lies on the Shield is also important. The people in this area have little interest in, or connection with, the lower Napanee Valley. During the summer a considerable portion of the population is made up of summer residents interested only in recreation.

Markets and the road net are also important. Provincial Highway No. 38 connects Kingston with Highway No. 7 and traverses the eastern portion of the watershed. This results in a direct orientation of this area toward Kingston and most of the people in Verona, Hartington, Bellrock Godfrey and so on rarely go to Napanee, Newburgh or that portion of the valley. In the west Tamworth attracts much traffic.



TABLE 2  
PRESENT LAND USE

Use		Acres	Per Cent
Hay		18,208	9.0
Pasture		36,146	17.9
Grain - Oats	7,620		
- Wheat	1,004		
- Mixed & Other	<u>442</u>	9,066	4.5
Row Crops - Corn	228		
- Potatoes	34		
- Turnips	<u>62</u>	324	.2
Market Garden Crops		280	.1
Fallow		370	.2
Idle		290	.1
Built Up (Urban, Farm Buildings, etc.)		2,684	1.3
Miscellaneous (Quarries, Gravel Pits, etc.)		308	.2
Water		10,880	5.4
Non-Wooded Swamp		1,056	.5
Forest (Largely Pastured)		58,790	29.1
Rough Open Land and Rock - Sparsely Wooded and Largely Pastured.		63,544	31.5
Totals		201,946	100.0



## CHAPTER 3

### LAND USE CAPABILITY

#### 1. Introduction

The use capability of land depends largely on the climate and on the inherent characteristics of the land. Within limits which are not necessarily rigid man may modify some of these factors by draining, irrigation, fertilizing, land leveling, the use of better crop varieties and so on. In general, however, the nature of the land determines the general use to be made of it and suggests the kind of use which should be made of it. The farmer should always try to fit his husbandry to the land, not vice-versa.

The aim of conservation is to adjust the use and management of land to its capabilities. In this way the greatest long-run economic return will be obtained and the continued productivity of the soil maintained.

On many of the fields on most of the farms of Ontario the land is variable in quality because of changes in the soil itself, in slope, and in drainage. Most farmers know and appreciate the fact of these differences and many, by themselves or with technical aid, adjust use to capability. To bring about efficient use of land each farmer needs to make an inventory of his land and its capability. Considerable assistance in this matter may be obtained through the Soil Advisory Service of the Ontario Agricultural College.

On a watershed such as the present one the Conservation Authority is vitally concerned with the question of land capability. Any program in which the Authority becomes involved should be carried on with thought to its effect on the land. The Authority should proceed on the principle of looking at the watershed as a whole and of planning present and future activities so that benefit accrues locally and over the whole watershed. To aid the Authority in their work the capability of the land for the whole watershed was judged and a map



delineating the various classes of land prepared. A copy of the map accompanies this report.

Land on the Napanee Watershed may be divided into two broad classes on the basis of its suitability for cultivation, and its unsuitability for this use. Within these two general classes several kinds of land, each requiring different use techniques, may be distinguished.

2. Land Capability Classification in Terms of Recommended Use

A - Land Suitable for Cultivation

Class I - Unrestricted Agricultural Use

Land suitable for normal cultivation practices without any serious limiting considerations.

Class II - Restricted Cultivation

Land of lower capability than above due to shallow soils, lower fertility, susceptibility to drought and erosion and in some cases boulderiness.

Class III - Conservation Farming

This land is susceptible to moderate or severe erosion, or is already so affected and requires specific techniques to keep it productive.

The land is characterized by long, smooth slopes of between 4 and 10 per cent, which lend themselves to contour cultivation, strip-cropping, grassed waterways and, in some cases, diversion terraces.

Class IV - Drainable Land

This land requires artificial drainage, either tile or ditch, before yields can be improved.

B - Land Suitable for Permanent Vegetation

Class V - Pasture Land

Although occasional crops may be taken from this land it is best suited to Permanent pasture. Existing woodland should be retained so far as possible, but should be properly managed for best yield.



Class VI            -    Woodland

Because of shallow soils, impeded drainage, steep slopes, infertile, bouldery and hummocky soils this land is best suited to forest as a long term use. Because of the many water bodies associated with this type recreational use is also important.

(a)    Class I - Unrestricted Agricultural Use

This is the most versatile and highest quality general farming land on the watershed. It is suitable for cultivation in normal rotations such as are currently practised throughout Southern Ontario. With ordinary good usage, and use of fertilizer and good tillage methods satisfactory yields can be expected without any deterioration of the soil and the land can support a wide range of crops.

It will be noted that this highly desirable type of land is limited in extent. Some of the heavier till in the Moscow district, where the slopes are less than 4 per cent and the drainage is satisfactory, falls into this category. Areas of light and medium-textured tills in the Napanee Valley and the south-east section of the watershed where the topography is very level (slopes less than 4 per cent) can be considered Class I land. Small areas of level but well drained clay loam in the vicinity of Napanee and the area to the west also belong to this class.

Although there are no special problems connected with this land, the conservationist is vitally concerned with its future use. Failure to maintain satisfactory crop rotations on these soils, or to return sufficient organic matter to the soil, could deplete these valuable lands. It must always be remembered that only through the best use of his high-class land can the farmer relieve the burden on his poorer land. The proper use of this Class I land is an integral part of a soil conservation program.

(b)    Class II - Restricted Cultivation

This is land of lower inherent capability than that above, but the soils are suitable for cultivation with



*Between the granite rocks muckland can sometimes provide fair hay if properly managed and not overdrained.*



*On the limestone plain many acres of pasture are being overrun with weeds, juniper and other unproductive shrubbery.*

*Many opportunities for farm pond construction exist on the limestone plain. Ponds should be deeper than this one if possible, and fenced for longer life. This would make an ideal pond of the dug-out type.*





certain limitations and restrictions. The nature of the slopes does not lend this land to mechanical methods of erosion control such as contour tillage. A wide variety of factors have placed this land in a lower category and each of these limiting factors will require some specialized form of treatment to ensure continued high productivity.

There are large areas where the soil is approximately three feet in depth. These soils can be cultivated, but numerous hazards are present. In a dry season, drought can be a serious handicap. Fortunately, the topography is relatively level and accelerated erosion can be kept to a minimum. However, any soil loss on these shallow profiles is crucial and caution in use of them must be exercised to check this menace.

Some land in the Centreville area falls into this category because of hummocky topography. The slopes, between 4 and 15 per cent, are short and broken. Erosion is not usually severe but the nature of the slopes, coupled with low soil organic content and shallow profiles present dangers in this regard which only a satisfactory husbandry can deal with.

In some areas, especially on the Shield and on the sandy soils in parts of the Napanee Valley, low fertility, coarse texture and low organic content limit the productive capacity of the land. Drought is common on these lands due to rapid percolation of the precipitation.

Taken as a group, these Class II lands are limited in use capability by one or a number of factors including lower inherent fertility, shallowness of profile and soil depth, and a susceptibility to drought. They are satisfactory for normal cultivation provided proper methods of cultivation are used. The application of adequate amounts of barnyard manure and fertilizer is, of course, a requisite.



Every effort should be made to check soil deterioration and build up the fertility and organic content of these soils. Commercial fertilizers will increase yields in most cases and are usually required for normal cultivation. The organic content must be maintained by the use of green manure crops and the liberal application of stable manure.

The land should be kept under vegetative cover as much as possible and some form of winter cover is highly desirable. Long-term improved pasture is an excellent cover for the rougher, more eroded and less fertile of these lands, but the relatively low percentage of cultivable land on many of the farms involved makes this treatment difficult.

The slopes associated with these areas do not lend themselves as a rule to mechanical methods of tillage such as contouring and strip-cropping. But whenever possible the land should be ploughed at right angles to the slope rather than straight up and down the face. In some cases this may require a slight rearrangement of field size and shape, but in many instances it is simply a matter of a break with tradition and habit. Surplus water should be carried away on grassed waterways.

(c) Class III - Conservation Farming

This class represents productive land of light to medium texture with long smooth slopes between 4 and 10 per cent. The whaleback hills or drumlins and some of the more gently sloping sides of the Napanee Valley constitute the bulk of the land in this grouping.

The erosion on the slopes, up to the present time, has been slight to moderate in most cases. In a few places the whole of the topsoil has disappeared. With adequate care it should not be difficult to improve these soil conditions and increase yields. However, if care is not taken the soil will gradually deteriorate.





*Raspberries are an important crop near Napanee.*



*Truck gardening south of Napanee. Up and down hill cultivation aids erosion and should be discouraged.*



The long smooth nature of the slopes renders them highly suitable for mechanical methods of erosion control such as contour cultivation, strip-cropping, grassed waterways and, in some instances, diversion terraces. These proven methods of conservation farming should prevent the accelerated movement of soil from the crown of the hills and the steeper slopes.

The land requires heavy manuring and in many cases longer rotations than are normally indulged in. A trash covering on the soil is desirable during the winter months to check the loss of soil by wind action and the effect of wash from sudden thaws in spring. The continued production of row crops on these lands is not advised because of the erosion problem.

(d) Class IV - Drainable Land

This land class includes areas which require artificial drainage, by tile or ditch, to yield maximum economic returns and where the soils are sufficiently deep and are easy to drain.

Not all poorly or imperfectly drained areas are included in this category. Often the soil is of insufficient depth above bedrock to warrant such treatment. In some cases there is no satisfactory drainage outlet at hand. Most of the areas in wet-site woodland or marsh are best left in this natural condition to act as water-storage reservoirs.

Much of the clay loam in the vicinity of Napanee and some of the low-lying heavier tills of the Moscow region require draining, as do some areas of silt and sand in the floor of the Napanee Valley. Satisfactory drainage would markedly improve crop yields on these soils.

Some areas have already received drainage treatment while others have not. No attempt was made, during the field survey, to map and record tile and open ditch drains on the watershed. Compared with some areas in Southern Ontario, field drainage is not a paramount problem on the watershed.



(e) Class V - Pasture Land

This is land of proven lower capability which, due to shallowness of profile, steepness of slope, or susceptibility to drought, is unsuitable for continued normal cultivation. The soil is capable of supporting a permanent sod cover of good to medium quality. Occasionally certain fields may be broken for cultivation, but the land cannot produce satisfactory yields under intensive cropping without very serious deterioration.

The main determinant which places land in this class on the Napanee Watershed is shallowness of profile. Generally the soils are a foot to two feet in depth or less. Drought is a serious hazard in summer in most years. Much of the land is relatively level, and erosion from run-off is not severe.

In an area just west of Enterprise, hummocky topography combined with a bouldery phase of the soil renders the land most suitable for pasture and very limited cultivation. No change in use is required here, as the area is currently in pasture.

At the present time, much of the land denoted as suitable for pasture is undergoing cultivation of varying intensity. A considerable change in land use practices will be required to bring the area into use practices which conform to its long-run capabilities.

Improved permanent pastures are required on these soils, but considerable experimentation with mixtures will likely be necessary to ascertain what is the best sod cover for this type of land.

(f) Class VI - Woodland

This includes land which is suitable only for woodland development. The shallow nature of the soil is an important feature, excluding agriculture from much of this land. Many acres of limestone plain or granite rock-knob uplands

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are completely devoid of soil cover. Considerable stretches have only a few inches of soil cover.

Poor drainage, such as is encountered in the Cameron Swamp and large sections of the Canadian shield, makes many areas unsuitable for normal agriculture.

Steepness of slope, ranging from rocky cliffs to steep grades between 15 and 20 per cent, exclude agriculture from some sections. The kame terraces in the Napanee Valley are a good example of steeply sloping, gravelly and droughty land which would be best utilized for tree growing.

The section of the report which deals with areas recommended for acquisition and reforestation by the Napanee Authority outlines several areas which are in need of such treatment. While these areas do not indicate all the land in need of reforestation they represent substantial core areas from which expansion of the reforestation program might proceed either by further acquisition by the Authority or the encouragement of private reforestation or improved woodland management.

TABLE 3  
RECOMMENDED LAND USE  
LAND CLASSES

Class	Acres	Per Cent
I	7,311	3.6
II	17,245	8.5
III	4,996	2.5
IV	11,082	5.5
V	13,257	6.6
VI	137,175	67.9
Water	10,880	5.4
	201,946	100.0



## CHAPTER 4

### CONSERVATION MEASURES

Summer drought and poor land are the two great factors limiting the general development of a highly prosperous and diversified agriculture in the Napanee Watershed. Partly as a result of this the economy of the area is geared largely to the production of animals and animal products. Even in those areas where the soil is of sufficient depth and quality the farm economy rests on the production of animal products. Exception to this is found in the southern part of the watershed where the production of vegetable cash crops on the heavier soils is fairly common and important.

Because such a large portion of the watershed is used for range, cultivated pasture, hay and forest there is no widespread problem of soil erosion. In those areas where deeper soils prevail and cultivation can be indulged in there is often serious soil erosion and fertility depletion. In these areas, such as around Moscow, Enterprise and in the Napanee Valley, it is imperative that the good crop land be maintained and improved. On these limited lands a successful agriculture depends.

It would appear that little improvement in the productivity of the thin soils on the limestone plain is possible. Not only is cultivation of much of this land difficult or impossible but drought is an ever-present hazard in late summer.

On the Shield the cultivable soils are limited in extent and haphazard in distribution. Swampy hollows, rough topography and a widespread surface bedrock effectively control and limit agriculture in this area.

In both of these areas broad-scale use of the land is limited to the production of natural pasture or forest. At the present time there is no doubt that such pasture as the

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land supplies is more valued than the forest production and little or no attempt is being made to improve the forest cover. The limestone plain seems well suited to the production of pasture but its carrying capacity in animals per acre should not be over-taxed. Large areas of it are heavily infested with weeds and brush and the Authority might well consider giving assistance in their removal. The overall deficiencies of the Shield suggest that the bulk of this area would be better served in the long run if maintained under a managed forest cover.

On those lands of the watershed capable of cultivation many measures may be used to arrest fertility loss and soil erosion and to overcome excessive soil moisture and water supply lack. These techniques have been developed over the years by agriculturists, conservation specialists and farmers themselves. They are designed to improve soil structure and fertility and soil-moisture relationships.

The improvement of the land on a farm may often be accomplished simply by changing the methods used. What was good enough in father's time may not be good enough today with its changing demands, shortage of labour and increased mechanization. In other cases more may be required than a simple change of method. Perhaps one or more fencelines should be removed to facilitate conservation cultivation, a line of tile placed to drain a wet spot, or some other measure installed. In any case the aim is increased productivity, better crops and animals, a better land and a saving in time and money.

To be assured that he is installing the correct measures and derives the most benefit from them the individual farmer should consult the Soil Advisory Service, Ontario Agricultural College, through his local Agricultural Representative, or the Agricultural Representative himself. It will often pay the farmer to have his farm planned by the farm planners of the Advisory Service. This service is provided free of charge.



The following conservation measures are a few of the more important ones which might be used to advantage in the watershed. There are many others which would find application in specific cases.

1. Contour Cultivation and Strip-Cropping

Contour tillage means the cultivation of land along the contour and at right angles to the slope. Easily contoured slopes are broad and smooth and possess a minimum of slope change or of surface drainage channels. The best installation of such measures may require the removal and/or relocation of one or more fencerows. When the land is tilled "on the level" each furrow or drill-row acts as a small dam to retain the run-off water, which is better able to be absorbed by the soil. It may not be possible to follow the contour exactly, but this should be done as nearly as possible. If the furrows or drill-rows are not on the line of contour, there is the danger of water accumulating in depressions behind the implement-formed ridge and breaking across it to cause rill or gully erosion. This may be overcome by careful tillage and by providing grassed waterways in normal drainage channels.

Strip-cropping is often carried on in conjunction with contour tillage. This involves the establishment of alternating crop strips across the slope. Some strips would be devoted to grain or intertilled crops, and the strips between would be in hay or pasture. By the use of such a practice any water which escaped from the cultivated strip and which carried soil with it would be checked by the grass strip, with the result that the soil load would be dropped.

Contour tillage not only helps to save the soil but saves money and time. Experiments in the United States have shown time savings of 10-15% and fuel savings of the same magnitude simply by working at right angles to the



slope instead of up and down it. Experience in Ontario has been similar.

The amount of land suited to contour cultivation in the watershed is relatively small but there are many areas where its use would be beneficial. A great many of the drumlins, where the slopes are not too steep, could be cultivated in this manner to advantage.

## 2. Crop Rotations and Cover Crops

All of the well-drained or drainage-improved cultivable land on the watershed should be managed using crop rotations suited to the soils and needs of the individual farm. Carefully planned crop rotations, skilfully carried out, constitute a major soil conservation measure.

A good rotation makes the best use of the soil and is so designed that there is ample return of organic matter either as green manure or as crop residue. The inclusion of legumes leads to an increase in the nitrogen content of the soil and provides much organic material.

Rotations should be worked out so that the land is kept under vegetative cover as much as possible. By so doing the soil is not so easily compacted and eroded by heavy rains and melting snow. Where it is planned to leave a field fallow, it is advisable to cultivate so that much of the crop residue is left on the surface.

The cropping program will vary from farm to farm and will depend on the farmer's needs and the soil. The rotation may be arrived at independently by the farmer and may be quite satisfactory, but greater assurance may be obtained by having a farm plan.

## 3. Artificial Drainage

The cultivable land of the watershed is not marked by widespread conditions of deficient soil drainage. There are, however, many fields where drainage problems exist.



In many cases the areas involved are small and the trouble and expense of correcting the condition would be out of proportion to the benefit gained. Often, however, satisfactory relief may be obtained at relatively small expense, certainly small enough to be paid for in a short time in increased yield. Depending on conditions and requirements weeping tile or open drains may be used.

To provide good outlets, the last few feet of tile drain should be of vitrified tile or corrugated metal pipe extended a few feet out into the ditch or stream. A head wall to prevent back-cutting and an apron to prevent scouring and gully development should be provided. The open end should be screened to prevent the entry of animals.

Ditches should be provided with gentle side slopes to prevent slumping and the spoil banks should be spread out. Spoil banks left in the rough are unsightly, are unproductive and harbour weeds. So far as is possible, ditches should be fenced from cattle to prevent trampling, sedimentation and bank destruction.

#### 4. Pasture Improvement

Although there is much pasture on the watershed which is incapable of satisfactory cultivation and improvement there is a great deal which may be so treated. As often as not, however, the pasture is relegated to the poorest of land and little or nothing is done to improve the quality or carrying capacity. Where good land is used the same is all too often true. The number of beef or dairy cattle or sheep that a farm may carry is directly related to the quality of the pasture. Pasture is a major land use in the Napanee Valley, not a minor one, and it should be given the attention worthy of its importance.

On the cultivable land some of the pasture has been in for so long and has become so thin and weedy that it



would be desirable to reseed or renovate it. Specific recommendations for the preparation and seeding of pastures may be obtained from bulletins distributed by the Department of Agriculture.\* In addition the local Agricultural Representatives stand ready to help any farmer with his pasture problem.

Soil tests and the use of fertilizer should not be neglected in the building of better pasture. Further, it should be realized that the quantities and types of seed to be used will depend on the type of soil in the field and the use of the pasture.

Management after seeding is important in maintaining a high level of production and in ensuring that the best possible return is obtained after the expense of working, seeding and fertilizing. Outlays of this sort will be recouped probably only after three or four years, but beyond that time a higher return will be gained than if the pasture was unimproved. Periodic clipping helps to produce a thicker turf and a more even stand and aids in restricting the growth of weeds. A further factor in pasture management is that of ensuring, so far as is possible, that no over- or under-grazing takes place.

Where the soil is too rough, stony or thin to cultivate probably little can be done in the way of pasture improvement. The clipping of weeds and the removal of unproductive brush are practices which might often be used to advantage.

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\* Useful bulletins include:

- (a) Guide to Crop Production in Ontario. Ontario Department of Agriculture, Extension Bull. No. 68.
- (b) Soil Management and Fertilizer Use. Ontario Department of Agriculture, Bull. No. 497.
- (c) Better Ontario Pastures. Ontario Department of Agriculture, Bull. No. 469.
- (d) Fertilizers for Cereal, Hay and Pasture Crops. Ontario Department of Agriculture. Circular 144 (Rev. May 1955).
- (e) Better Pastures in Eastern Canada, Department of Agriculture, Ottawa, Pub. 809. Farmers Bull. 150, Oct. 1948.



The general field of pasture management in the Napanee Valley is open to investigation and the Authority might consider giving a lead in this field, either in co-operation with a farmer or on land acquired specifically for the purpose. Assistance and advice from the Agricultural Representatives and interested farmers' groups should, of course, be invited. Information on pasture management on the thin soils of the limestone plain would be particularly valuable.

##### 5. Farm Ponds

A large portion of the Napanee Watershed is fairly well watered by surface streams and probably the majority of farms have access to a surface water supply. There are, however, numerous farms where this is not the case, particularly on the limestone plain in late summer, and the water supply problem can become acute.

Farm water deficiency can often be overcome by the installation of a farm pond suited to the needs of the farm and the physical site. The simple dug-out pond is most widely used in Ontario and is well adapted to those areas where the water table is not too far below the surface. In other instances a run-off or by-pass type of pond may be more suitable. Sometimes a pond may be spring-fed.

Not only do ponds supply the immediate needs of livestock but they may often be used for recreational purposes and, if the location is satisfactory, for fire protection. Depending on the type they may also aid in the maintenance of the water table and stream flow.

Rather few ponds have been built to date in the valley and the nearness of bedrock to the surface is often a deterrent to their construction. Even on the limestone plain, however, there are wet areas where the soils are sometimes deep enough to permit satisfactory pond construction. Before a pond is built considerable thought should be given to the type required and the sites available.



The fact that so few ponds have been built may, perhaps, be due to the fact that many farmers are unaware that the Authority stands prepared to assist them in this matter. A progressive policy of public relations would do much to overcome this deficiency.

#### 6. Grassed Waterways

In many places natural waterways cross a slope, and in the spring or after a heavy rain they may carry a considerable volume of water. Often, in fact usually, such a channel is cultivated with the rest of the field and receives no protection. This situation is ideal for gully development, and once started its growth may be rapid. Where such a course enters more level land at the bottom of a slope, considerable material may be deposited and a delta formed and the growth of crops restricted.

When such a channel is grassed, it is placed in permanent sod, with the strip wide enough to take care of any foreseeable water flow. The permanent sod reduces the speed of flow and the erosive action of the water and, if large enough, could be used as a source of hay or pasture. Grassed waterways greatly reduce the risk of gullying and they could be installed with benefit at many places.

#### 7. Farm Planning

To most farmers the idea of planning is not something new; in some measure or other they plan the use and management of their land so that they know a year or so in advance what cultivation sequence they are going to follow. They plan for repairs to buildings, equipment, fences and so on. They plan so far as they can the day to day and month to month work they are going to do, and much of it becomes routine. Planning, in short, is an essential feature in the life of the farmer as it is with anyone concerned about his future.



Although many farmers have a plan regarding the use to which they put certain or all of their fields, relatively few have had their farms planned so that the maximum use, consistent with the best use, is made of each piece of land. The object of a plan of this sort is to enable the farmer to get the most out of his land and at the same time to do it in such a manner that no damage to the land occurs. When a farm is planned each piece of land is judged according to its capability to produce, and various use recommendations are made. These may include pasture management, crop rotations to follow, woodlot management and reforestation, farm drainage, fenceline removal or relocation, or any other works and practices which would benefit the farmer and his land.

Planning does NOT need to be so rigid that there is only ONE recommended use or management for a piece of land of one class. Alternative recommendations may be made for a piece of land in a certain class. The first rule is to apply the easiest and cheapest remedy. The next thing that determines the choice of use is the relation of the field to the rest of the farm. Other factors apply, such as suitability for using powered mechanized equipment, or the distance from the barn and ease of access. The final determination depends on the crops and animals the farmer chooses to carry. The final plan, therefore, is the end result of a good many compromises and at each stage of preparing the plan certain choices have to be made.

In developing the plan a farm planner goes over the farm field by field and maps the soils as he finds them. He uses an aerial photograph as a base map. The soil series and types are identified and an estimation of the degree of erosion is made by examining vertical sections of the soil. The slope of the land is measured, using a hand level which gives slope as a percentage. A rise of four feet in a run of one hundred feet, for example, is a 4 per cent slope.



The occurrence of watercourses, either permanent or intermittent, with or without a definite channel, is noted, as are fencelines, stonepiles, springs, seepage areas, gullies or any other items of importance.

All of the information gathered is marked on the map, using symbols, and each piece of land of the same type with respect to soil, slope and erosion is delimited by a boundary line.

From the map of soil types and conditions a map of use capability is prepared. Each piece of land is assigned to one of eight capability classes. On any one farm not all classes will necessarily be found.

The plan of the farm is then worked out with the farmer so that each field, or each piece of land, is put as nearly as is practicable to the use which fits the capability. Any systems of tillage or cropping or special practices to control erosion and water loss are applied where necessary. The fields and rotations are worked out so that there is the correct balance of pasture, fodder and grain to meet the requirements of the herd which the land can carry.

Before the planned rotations are put into effect it may be necessary to arrange a transition period in which the change-over from present cropping to the planned rotation is made without losing a year of cropping. Also, it may take a year or two to get special devices like grassed waterways and terraces in working shape. A time of transition such as this may also prove useful in providing a period during which any desired changes in the plan may be implemented.

In adjusting use to capability it may not be possible to outline fields exactly according to natural soil conditions. The inclusion of a small area of, for example, Class II land in a field which is predominantly Class I land may mean that this small area of land of lower capability will be worked as intensively as the Class I land. This is not



strictly following the principle of "using each acre according to its ability", but is a compromise weighed against the possible cost of fence removal, difficulties of tillage and so on. In a plan, therefore, there may be found one or more small areas of one land class within a larger area of another land class.

Experience on a number of planned farms in Ontario has shown that, properly carried out, changes of use and methods of use of the land can pay substantial dividends. Using the land according to its capability and with integrated conservation methods helps to reduce erosion, increase water insoak and lower run-off, and increase soil fertility. Properly applied conservation farming methods help put more money in the farmer's pocket although they may, of course, require some initial outlay. Conservation farming is, after all, nothing more than good farming on a planned basis. It can and does result in higher yields, more animals per acre, lower costs and higher returns.

At the present time only 9 farms have been planned in Lennox-Addington and Frontenac Counties and the Napanee Authority can assist this situation materially by publicizing the fact that the Ontario Government, through the Soil Advisory Service of the Ontario Agricultural College, provides free farm planning surveys and assistance. The Authority should, of course, work in complete co-operation with the local Agricultural Representatives and farmers' groups.



## CHAPTER 5

### CAMERON CREEK BOG

#### 1. Location

The Cameron Creek (Verona) Bog is a bog of the low moor type. It extends from Highway No. 38 in the east to Camden (Mud) Lake in the west and covers the zone of contact between the Precambrian and Paleozoic rocks. Its east-west extent is about 8 miles and its breadth a mile or more. The area involved is about 8,000 acres.

The bog is crossed by three north-south roads, including Highway 38, and also by the Canadian Pacific Railway at its eastern limit. Another line of the C.P.R. also passes near the bog on the west. A line of the C.N.R. passes through Yarker and Harrowsmith on the south. A number of communities surround the bog: Verona, Bellrock and Enterprise on the north side and Moscow on the south.

#### 2. Reason for the Survey

In order to appraise the suitability of the bog for agricultural use a brief survey of the area was made in the fall of 1956. At this time of year the bog was reasonably dry and quite accessible. Enquiry was made as to the nature and extent of the peatland, soil reaction (pH), and the nature of the forest cover.

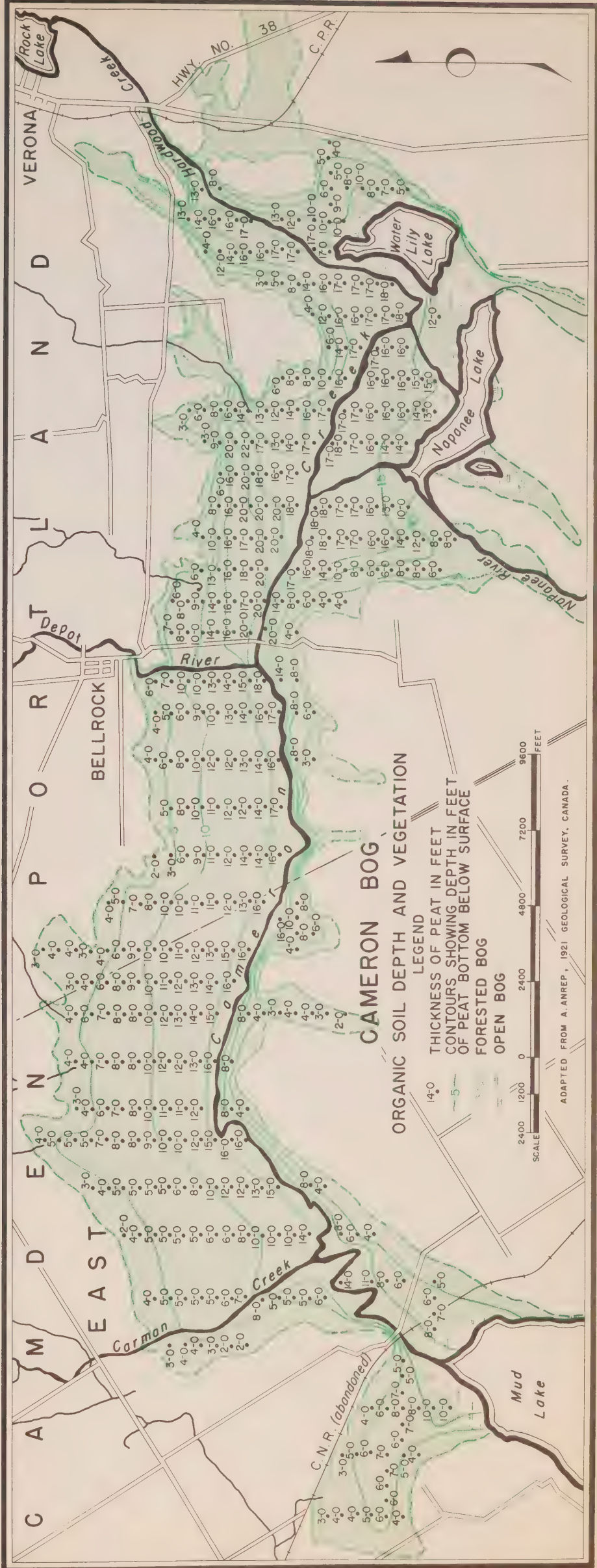
#### 3. Previous Surveys

The only other known survey of the bog was made prior to 1921 by A. Anrep for the Geological Survey of Canada. This survey was one of many carried out in Ontario over a period of years for the purpose of determining what bogs would be useful as a source of peat fuel.

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\* A. Anrep. Investigation of Peat Bogs in Ontario. Summary Report, 1921, Part D, Geological Survey of Canada.







#### 4. Description of the Bog

Anrep's observations on the Cameron Creek Bog are of considerable interest:

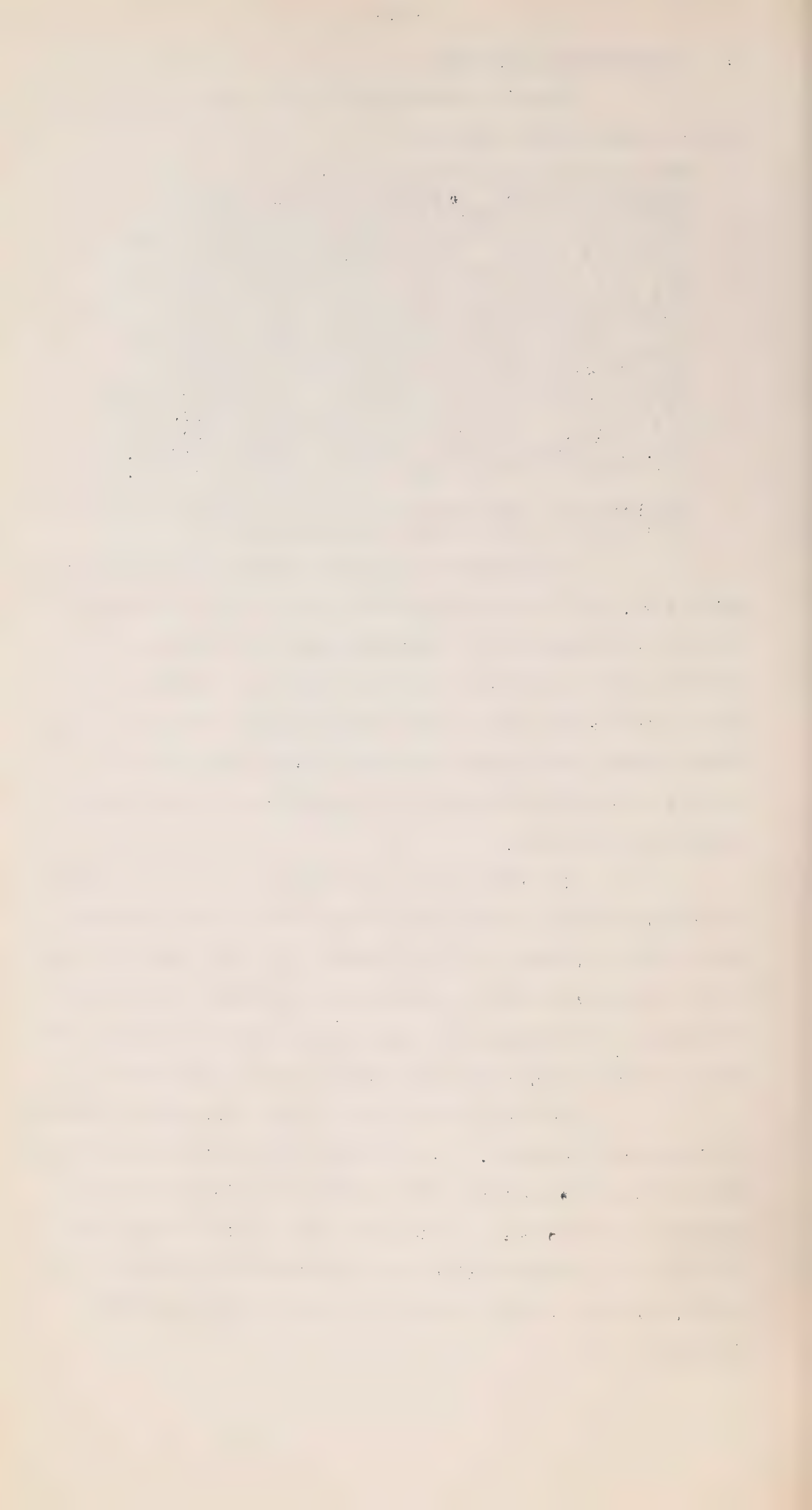
"The peat throughout the whole bog is very well humified, has good cohesive properties, and possesses a considerable depth. The peat is composed mainly of carex remains of grasses, dead trees and shrubs. No sphagnum was encountered and only once a few hypnum plants were noticed. The bottom layers of the bog are composed of aquatic plants below which is a layer of about 2 or 3 feet in depth of greenish gelatinous substance which seemed to be composed of vegetable and diatomaceous siliceous shells, freshwater molluscs, and littoral remains. The greater part of the peat is thickly intermixed with roots, logs, and stumps. The bog is very heavily wooded with ash, soft maple, birch, willows, poplars, alders, and numerous other varieties of deciduous bushes.

"The bottom of the bog is a thin layer of blue clay under which stone or sand is encountered."

This description fits observations made in 1956 quite well, but it is believed the peat is not so coarsely woody as he suggests. It does not appear to contain, for instance, such a profusion of heavy logs and stumps as is found in the woody peat of the Holland Marsh north of Toronto. Where heavier woody materials were encountered, they were usually very soft and easily cut through by the peat-sampling auger which was used.

The peat at the surface is usually quite dark in colour (nearly black in most cases) but a short distance down usually changes to a dark brown. By and large the peat is well decomposed but it usually contains many small woody fragments. Thin layers of more coarsely fibrous "grass peat" may be found at depth but the distribution is scattered.

The bog seems never to have supported a tamarack or sphagnum vegetation. Anrep notes the existence of a bottom layer of aquatic peat but this seems to be missing where the deposit is shallower. In any case, it is deep enough that it would not interfere with crop production or drainage. It might, however, provide some difficulty to drainage canal construction.





*In the granite country the hard, ice-scoured bedrocks at the surface prevent the development of a substantial agriculture. Note the Cameron Bog in background.*



*After the spring runoff most of the minor streams in the limestone country dry up.*



The present forest is of the hardwood type with soft maple predominating but elm and black ash intermixed. Where cutting of the forest has been complete, considerable shrubby growth may be found. By and large the forest floor is free from undergrowth of any kind, chiefly because of annual flooding and adverse light conditions.

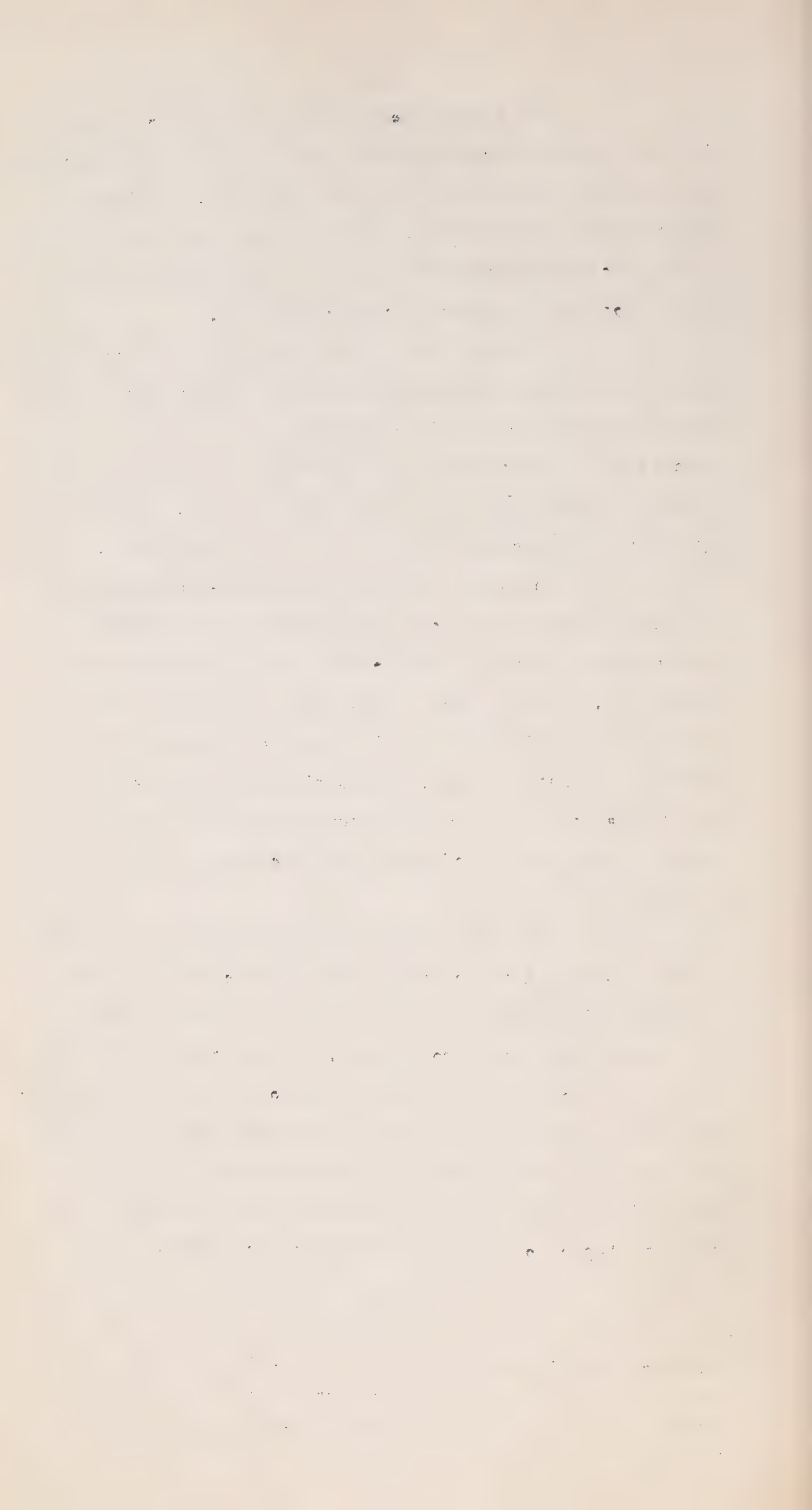
In only a few places, notably at the northern end of Camden Lake and near Napanee Lake, is the forest cover naturally missing or poorly developed. These areas were not explored but it is believed the vegetation is composed chiefly of sedges, swamp grasses, cattails and the like. Wild rice may be locally important in one or more of these areas.

There are several ridge-like outcroppings of Pre-Cambrian rock in the bog, particularly near Highway 38 and immediately west of the Frontenac and Lennox-Addington county line. Anrep's map of peat depth shows the first-mentioned area quite well but it fails to indicate the true extent of the latter ridge. This ridge is continuous well into the bog but it eventually becomes beaded in nature with the small rock knobs projecting well above the surface of the peat.

The map prepared by Anrep shows a large number of drill holes and the depth of peat at each hole. Overall the information given is believed quite accurate although it is known that some errors occur. Where checks were made the peat was found to be slightly shallower than he indicated. Generally speaking the peat ranges in depth from up to 3 or 4 feet along the edge to over 20 feet south-east of Bellrock. Most of it is deeper than the aforementioned minimum. The following table covers the area explored by Anrep.

TABLE 4

Depth of Peat in feet	0 - 5	5 - 10	10 - 15	15+
Acres	1,426	2,121	1,881	1,402



No attempt was made to determine the extent, nature and thickness of the mineral materials beneath the peat. All that is known on this subject is contained in Anrep's brief remark.

During the survey a limited number of tests were made in the field to determine the soil reaction (pH). In nearly every instance a near neutral (pH 7.0) or slightly alkaline (pH 7.0 +) reaction was obtained. The values obtained are undoubtedly due to several factors, probably chief of which is the intake by the bog of lime-rich waters entering from Camden Lake and the limey soils to the west and south. The Black River and Grenville limestones presumed to floor much of the bog no doubt contribute to the condition. The hardwood forest cover and the lack of an acid-bog vegetation reflect the "sweet soil" conditions.

Through a considerable portion of the year the bog is covered by water up to a depth of several feet. As already mentioned, this has a considerable influence in restricting the development of a forest understory. These natural conditions would appear to be unfavourable to wildlife generally and to certain species in particular.

Wild ducks and muskrat are the two most important species found but it is suggested that these are confined largely to the open swamp and open water areas mentioned above. They may also find favourable habitat on some of the streams running through the bog. The same is probably true of the pike fishery. Deer winter in the area, but the lack of browse would force them to frequent the peripheral zone where food would be more plentiful. Apart from a few birds inhabiting the open spaces the only mammal seen well in the swamp during the survey was a single porcupine.

##### 5. Possibilities for Agriculture

In the past, in Ontario and elsewhere, many attempts have been made to convert peat lands to agricultural use. All too often these attempts ended in miserable failure.



although a spectacular degree of success was achieved in others. The bog lands at Thedford, Pelee and Bradford are Ontario examples of the latter group.

Successful bog development depends on a number of things, including drainability of the bog, soil type (to which drainability is related), soil pH, soil depth, extent of the bog, local climate, type of use, and accessibility and distance of the area from markets. Most bogs suffer adversely in respect to one or more of these factors and the deficiency is usually sufficient to prohibit their use for agricultural purposes. In addition, not all bogs should be so developed because of their importance in water storage and as refuges for wildlife.

Other considerations aside, it is believed that a considerable portion of the Cameron Swamp, at least 3,000 acres, is suitable for agricultural use. The cost of development would preclude any use except the most intensive. The land would appear suitable for the production of truck crops.

The available acreage does not occur as a single undivided block but is split into sections of varying size by natural waterways. This does not necessarily present an insurmountable development problem, however, for each area might be diked and the waterways used as drainage canals. Because of the nature of the bog each dike-enclosed section would have to be pump-drained separately. Drainage works of this kind have been installed at the Holland Marsh.

The soils of the area under consideration appear to be suitable for truck cropping in several important respects. In the first place the organic deposit is amply thick in most cases for continued use over a lengthy period. All organic soils undergo marked shrinkage and wastage when drained and cultivated and they must, therefore, be sufficiently deep to warrant development.

In terms of soil reaction also the land appears suitable for vegetable growing. The pH range indicated would



render the application of a lime supplement unnecessary.

Although the bog possesses an extensive forest cover, most of the trees are of small size. Their shallow root development and the general lack of a shrubby understory would facilitate land clearing.

The questions of transportation facilities and markets would be important in the development of an area such as this for truck crops. Present road and rail outlets are good and no substantial improvements should be necessary, apart from the creation of an internal road system as needed. It might be noted that the area is about 150 road miles from Toronto and 25 to 30 road miles from Kingston. Access to the American market would be good, but competition from the muck-lands of Ste. Clothilde, Quebec, and the Holland Marsh would be severe. The rapidly growing home market should offer encouragement.

#### 6. Developmental Questions

Although a part of the Cameron Bog appears suitable in some respects for development as a truck crop area, there are other aspects of the question about which little is known.

Worthwhile generalizations may be made concerning the climate of the general region, but little if anything is known about local climatic conditions. The climate of the area would presumably be more like that of Tweed than at Kingston, due to its separation from Lake Ontario. Air drainage into the bog from surrounding higher land would no doubt increase the frost hazard and result in a shorter frost-free period than average for the region. This fact would be of importance in determining the types of crops which might be grown. It is thought that most of the frost-tolerant vegetable crops can be grown successfully. Clearing, draining and cultivating peatlands normally has a beneficial effect in ameliorating the local climate of these areas and the same might be expected in the Cameron Bog.



Not too much is known about the value of the bog for wildlife but it is thought that draining and clearing the land would be beneficial to at least some species. Experience elsewhere suggests that the draining of peatland for vegetable production is not harmful to the muskrat. The provision of many miles of drainage ditches and canals serves to increase the available habitat for the muskrat. Under the plan of development envisaged as feasible most of the land is forested and generally lacking in a muskrat population. The same thing would appear to be true for most waterfowl and for deer.

It has been mentioned that bedrock underlies the area and in one or two places rises above the layer of the peat. Anrep's work suggests that this factor would be no barrier to vegetable production but there is a possibility that drainage canal construction might be hindered in some places. Careful survey work should solve this question adequately.

Perhaps the chief problem involved in development of the bog for agricultural use is the one of its water relations. There is now no great flood problem on the Napanee River and it may be that the Cameron Bog plays an important role in reducing flood peaks by acting as a water spreading area. The draining of several thousand acres of land in the bog might thus result in downstream distress. However, the retention of 8,000 acre feet of water by the Second Depot Lake Dam could be expected to compensate for this potentially adverse effect.

A second question of water relations involves that of summer flow. Like that of flood control, little is known about the part the bog plays in helping to equalize it. There is a suggestion that the peat soil gradually delivers its water into the stream during the summer and if so, the effect of draining several thousand acres would be adverse. On the other hand, the part the bog plays in this matter may



be unimportant and the effect of canalizing parts of the several streams involved may well be beneficial. The drier the year the more important this might be in providing a less interrupted flow of the Second Depot Lake storage waters downstream. The gathering of stream flow records for even a short period would help greatly to answer both questions.

A third question connected to water is that of water supply. Assuming the development of several thousand acres of peat land for garden crops, it is quite likely that irrigation would be indulged in by at least some growers in dry periods. Under present conditions this might have a detrimental effect on downstream water supplies, but the disadvantage would have to be weighed against the value of an area producing perhaps several million dollars' worth of crops yearly and steps taken to remedy it.

One step which might prove beneficial is the impoundment of waters in the Camden Lake basin. This lake has an area of approximately 1,800 acres and the raising of its level by a couple of feet would provide 3,500 - 4,000 acre feet of storage. Part or all of this water might be used to augment the summer flow of the Napanee River in critical periods. The storage area might also be used to even out the river flow in the spring. Impoundment might be achieved fairly simply and at relatively low cost by using the embankment of the now-abandoned rail-line of the C.P.R. which crosses the swamp just to the north of the lake exit.

Assuming the general feasibility and desirability of developing the area for the production of truck crops, the question naturally arises as to how this development should be carried out and its relationship to the Conservation Authority. There are several ways in which development might be carried out and in each of them the Authority would have a greater or lesser interest. Several of these possibilities are discussed below.



If development were carried out on a purely private basis the individual owners would have complete control except as the interests of the Authority were affected in matters of water use, flood control and pollution. Development of this type has taken place in Western Ontario in the Thedford Marsh where drainage improvement and other matters rest in the owner's hands.

In the Holland Marsh development has been of two types. In the areas recently opened development has followed that prevailing in the Thedford Marsh and the individual is responsible for draining his land and maintaining his own drainage works. In the longer developed area, comprising some 7,000 acres, the situation has been somewhat different. In this area draining of the marshland was accomplished through The Municipal Drainage Act under the aegis of the municipalities involved, at the request of the landowners, and levies imposed on the land to pay for the works. A drainage commission is responsible for the maintenance of satisfactory water levels.

A third method of development, and one which would assure Authority control over the lands and waters should this be deemed desirable, would involve the acquisition of the necessary lands and their development as a scheme of the Authority. Drained acreage could then be sold or leased for gardening purposes. Under such a scheme the Authority would be able to develop the land to best advantage and have a measure of control over water use and management.

## 7. Recommendations

- (1) It would be desirable, before any action whatever is taken, to establish more completely the suitability of the land for truck gardening purposes, and the potential acreage of such land. Although the soil appears suitable for vegetable growing, some practical experiments should be carried out and soil analyses made.



- (2) The Authority should examine other muckland developments, such as the Holland and Thedford Marshes, to ascertain more completely the developmental methods followed and the relative merits and costs of each.
- (3) Marsh land truck cropping is becoming more and more the business of the larger grower because of higher production costs and more complex merchandising methods. Some of these growers have been searching for additional well placed and satisfactory mucklands and might be quite interested in the possibilities of the Cameron Bog. The Authority might consider discussing the question of bog suitability and potential with representatives of these growers.



## CHAPTER 6

### A RECOMMENDED PROGRAM

Taking the Napanee Valley as a whole the overall pattern of land use is in keeping with the broad capabilities of the land. These forms of use are dictated in large measure by the physical equipment of the region, its location with reference to markets, tradition, and the general movement of the economy. As has been seen minor changes in farming emphasis may take place from year to year and greater changes from decade to decade.

It is not envisaged that future land use will differ radically from that existing at the present time although there will likely be an intensification of present use forms in certain areas. There is a general trend toward larger farm holdings and fewer farms in Ontario and it is unlikely that the Napanee Valley will be unaffected in this regard. One may look, then, for farm abandonment additional to that which has taken place to the present time and the incorporation of these lands into larger holdings. The overall population of the valley will slowly rise however due to increased industrialization in Kingston and elsewhere in the area.

A large percentage of the Shield portion of the watershed is basically unsuited to a full-time agriculture or, for that matter, any agriculture at all, and full-time farmers in this area will never achieve a satisfactory income from this source. Most of the farmers will, as now, depend on supplementary income from other sources to maintain a reasonable standard of living. This non-farm revenue will come from industry, local and distant, from the tourist trade in all its forms, from mining and other sources. It seems possible that a major future source of income will derive from forest production. The bulk of these lands are best suited to forestry and the Napanee Authority is to be commended for the aggressive role it has played in acquiring such land for this purpose.



In those areas of the Shield where use of the land for agricultural purposes is possible and desirable more fruitful use of the land may, perhaps, be achieved through a greater integration of farm and forest production. "There is ... the need of an educational programme to develop the art and philosophy of true husbandry .... husbandry must replace exploitation in the minds of the farmer, the forester, the wildlife manager and the all-crop husbandman. Combination or multiple-use husbandry of a satisfactory type must be developed."\* In the years ahead the Napanee Conservation Authority may do much to promote and help bring about this type of development on the Shield. Multiple-use husbandry of this kind has been in existence for many years in some areas of Europe.

In the southern portion of the watershed agriculture is and will continue to be the main endeavour apart from possible industrial development. On some of the land it would be advisable to carry on a program of public and private reforestation or forest improvement and in these matters the Authority can accomplish a great deal through publicity, education and direct aid where this is deemed desirable and advisable.

Because of physical restrictions a large portion of the improved land is perhaps best suited to a grassland economy. Much of this grassland cannot be improved a great deal as things now stand due to soil conditions. Experimentation, however, may provide management methods applicable and profitable in this type of country. The Saugeen Valley Conservation Authority has acquired land for pasture experimental purposes and it is suggested the Napanee Authority consider doing likewise. It would be desirable to ascertain

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\* Hills, G.A. The Role of Forestry in the Conservation of Settlement Lands in Ontario. Soil Research Brief No.5, Ontario Department of Lands & Forests, 1949.



the cost of removing scrub growth where it exists, cultivation and seeding methods, desirable seed mixtures, and the benefits from fertilizer application. A program of this kind should be carried on with the full co-operation and assistance of Farmers' groups, local agricultural authorities and agricultural product and implement dealers.

Most of the balance of the land may be considered cultivable. Compared to the size of the watershed, however, the available acreage is small and every reasonable means should be taken to preserve it from deterioration and improve its productivity. On the bulk of this land one or more management practices may be applied with benefit; on many acres satisfactory measures are already being applied but more can be done to the ultimate benefit of the farmer and his land.

Improvement of soil fertility, tilth and water relations may be achieved through the application of the correct types and amounts of fertilizer, through crop rotations, pasture management, contour tillage, drainage and all the other measures which help to produce a healthy land and farm economy. Not all of these measures are applicable, of course, on any one farm but on most farms one or more of them may be applied to advantage.

The Conservation Authority can help the cause of conservation farming greatly through a well-directed program of publicity and public education. Heartening results will not be achieved overnight but a consistent program will produce results.

The Authority may also feel it desirable to aid the agricultural community in a more concrete fashion. It may, for instance, arrange for advice and assistance in farm pond construction, woodlot protection and management, grassed waterway construction and so on.

In the matter of publicity, too, the Authority may help to make the farmers more aware of the fact that soil



testing and land use planning on a farm basis are facilities offered free by the Province to those who wish to take advantage of them.

The Authority is also urged to explore fully the possibilities for development of a substantial portion of the Cameron Swamp for vegetable growing purposes. If this area does prove ultimately suitable for this type of use it could have an important effect on the economy of the area. As a body dedicated to the improvement and wise use of land and water resources the Authority would have a substantial interest in the area.

In the matter of conservation generally the Authority should seize every opportunity to publicize its activities and accomplishments. Promotion may be effected through the press, radio, television, schools, agricultural fairs and shows, and agricultural organizations.



# FORESTRY



CHAPTER 1  
THE FOREST

1. At the Time of Settlement

The Napanee Watershed may be divided topographically into two main sections, the northern two-thirds lying on the Laurentian Shield and the southern one-third on the Limestone Plain. The dividing line follows roughly the south boundary of the great hardwood swamp through which Cameron Creek flows. On the west it passes through Enterprise, north of Moscow and Petworth and in the east just north of Hartington and Holleford. The Shield area, embracing Sheffield, Hinchinbrooke and Bedford Townships, is typical of much of Ontario's northland with rounded igneous rock interspersed with lakes and patches or pockets of shallow soil which is usually sand or gravel. The Limestone Plain is a region of level sedimentary rock with a very shallow covering of soil in most places. A description\* of Hinchinbrooke Township was made in 1856:

"The larger part of the township presents an extremely rugged and broken surface composed of primary and volcanic rocks, swamps and lakes which together with fallen timber (the effects of wind and fire) afforded continuous hindrances in the progress of the survey. Fossiliferous rocks are wholly absent, and I am not aware of any mineral discovery of value.

"The shores of the lakes are in general bold and rocky with deep water which in some instances is beautifully clear and abounding in various kinds of fish. There has been much valuable pine timber and considerable yet remains. Notwithstanding so large a portion is unfavorable to settlement, there are numerous small tracts of good land scattered here and there, in different parts which from an acquaintance with what is now occupied, I believe would be settled upon if the class of settlers who usually settle these back parts had access to them. Although very little has been expended in making the principal road into the township, in addition to the labour performed by the settlers themselves, there are now upwards of seventy families, actual settlers. And there are four saw mills and a run of stones for grist.

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\* Report Hinchinbrooke Twp., Gibbs, 1856. Ontario Department of Lands and Forests Records, Notebook No. 1304.



"By opening a way from the present settlement near Cold Lake the back part of the township somewhat near the Boundary line between Olden and Kennebec, at present inaccessible, the number of settlers would be doubtless soon increased."

The above account would apply very well today except that fire has completely destroyed the forest over thousands of acres and all has been burned down to mineral soil and rock. Many acres have been cleared which should have remained in forest cover.

No early descriptions of the forest on the Napanee Watershed appear to exist, but conditions were probably similar to those in Hastings County and the interesting article entitled "Our Forest Trees", written by John Macoun,\* who later became botanist and naturalist with the Geological Survey of Canada, is applicable here. He lists the species which occur and gives brief descriptions of them as follows:

White pine - the most important tree, grows to 150 feet and over. (Though he does not say how abundant it was or where it occurred he implies there was a good quantity widely distributed.)

Red Pine - rather scarce.

Hemlock - little used for lumber in Eastern Canada (the quality of lumber it provided was too poor).

Balsam and Black Spruce - abundant in swamps and low woodlands - much used for rafters in barns and houses.

White Cedar and Tamarack - form extensive swamps in many parts of the county - cedar used in fencing and tamarack in shipbuilding.

Red Cedar - sometimes found along the Moira - used for lead pencils.

Rock Elm (Ulmus racemosa), White or Swamp Elm (Ulmus americana) and Slippery Elm (Ulmus fulva) - are abundant in most parts of the county. The first two are made into square lumber and exported in large quantities. The last

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\* Directory of Hastings County, 1864. p.26.



seems only of value for its inner bark which contains quantities of mucilage.

Oak - six species of oak - white (Quercus alba), black or red (Quercus rubra), blue or swamp (Quercus prinus) are abundant in all parts of the county. Mossy cup oak (Quercus macrocarpa) occurs along the Bay of Quinte. Scarlet oak (Quercus coccinea) appears on the Oak Hills and chestnut oak is rare.

Ash - three species of ash, white ash (Fraxinus pubescens)\* red or rim ash (Fraxinus sambucifolia)† and black ash are all useful. White ash is much used by carriage-makers and black ash by coopers and basket-makers.

Birch - yellow birch (Betula excelsa)\*\* , black birch (Betula lenta) and canoe birch (Betula papyrifera) are all used in cabinet work.

Poplar - Populus tremuloides, Populus grandidentata and Populus balsamifera are all abundant, the last in the swamps.

Hickory - shellbark abundant near Belleville and to the east; bitternut hickory abundant in most parts of the county.

Butternut - abundant in many places in the front townships.

Sugar Maple - abundant in all good soils as are beech and basswood.

The remaining trees are soft maple, striped maple (Acer pennsylvanicum), ironwood, black cherry (Prunus serotina) and the nettle tree (Celtis occidentalis). This last he found on the Salmon River.

In general Mr. Macoun's observations are correct though it is extremely unlikely that Quercus prinus, Quercus

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\* Fraxinus pennsylvanica Marsh. is the name generally accepted today for red or rim ash.

† Fraxinus nigra Marsh. is the name generally accepted today for black ash.

\*\* Betula lutea Michx. is the accepted name for yellow birch.



coccinea or Betula lenta occurred as these three species have not been authoritatively reported from this county. However, chestnut oak definitely occurs in isolated patches at the south end of the Napanee Watershed; hackberry is present on the bottom lands of the Moira River and red cedar is fairly abundant in the extreme south end of the watershed.

There is an interesting account\* of a vessel being built of this material:

"In the first year of the present century, there was built in the township of Marysburgh a short distance west of the Stone Mills a schooner of some celebrity...It was made altogether of red cedar, a kind of wood formerly very plentiful along the bay, and which possesses a most agreeable odor and is extremely durable. The vessel was named the Prince Edward."

The forests of the watershed then were predominantly hardwood of which hard maple was by far the most abundant species. The maple forests contained much basswood, some beech and a considerable amount of white pine. White pine also occurred in pure stands on the sand areas. The forests at the extreme south end of the watershed were made up largely of white oak, red oak and shagbark hickory. The swamps on mineral soils were chiefly hardwood including white elm, soft maple and black ash. On the peat and muck areas they were largely coniferous woods with black spruce, cedar, tamarack and balsam predominating but with a fair admixture of white spruce and yellow birch.

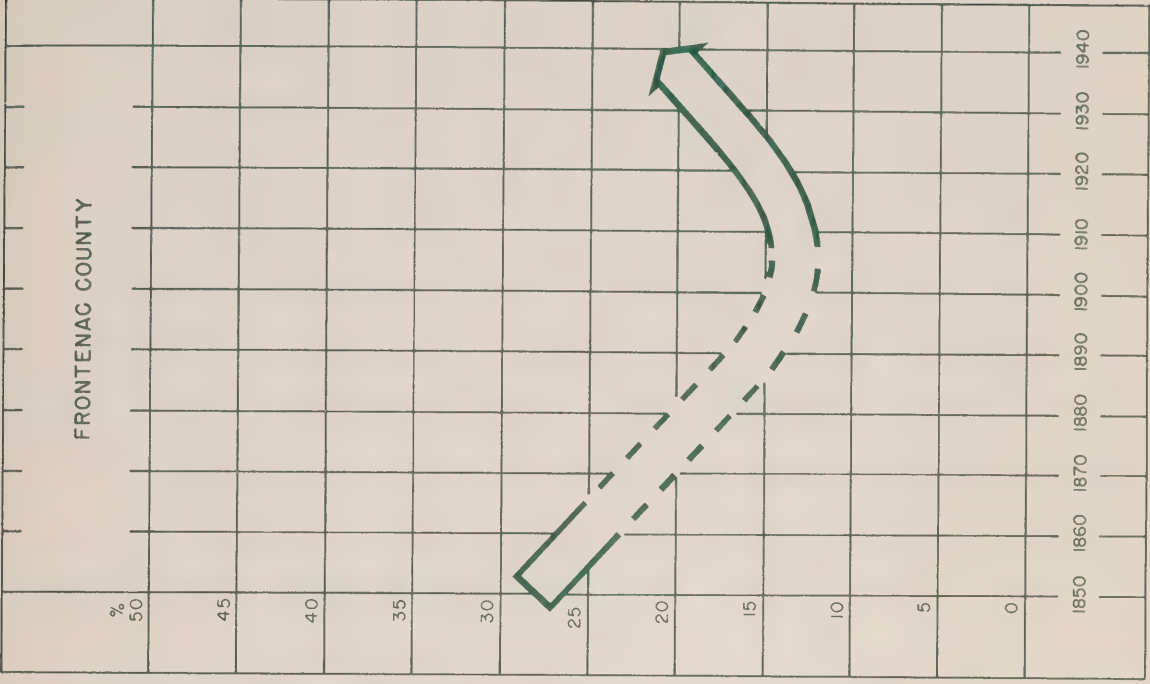
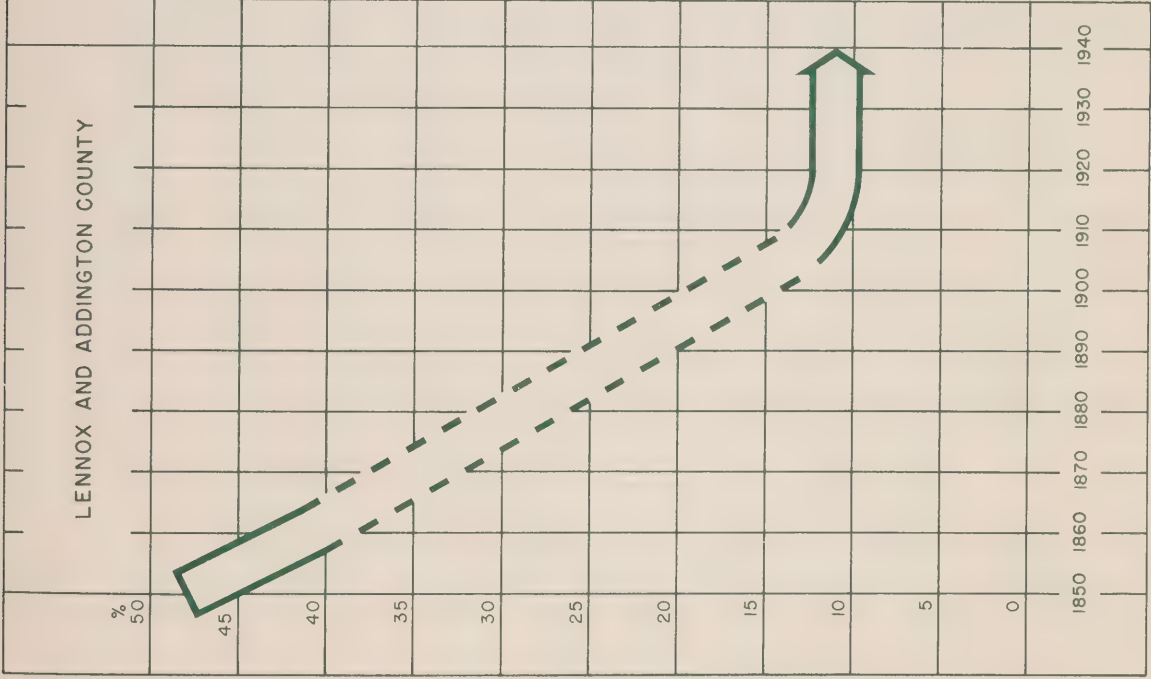
## 2. Since Settlement

The map of the Napanee River itself suggests lumbering, for a whole succession of lakes are named from First Depot Lake near Bellrock to Sixth Depot Lake near the headwaters. These names give the impression that logging operations, particularly for pine, were very extensive and fanned out over most of the northern part of the watershed.

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\* Canniff, Wm. The Settlement of Upper Canada. 1869.





PER CENT WOODLAND ON OCCUPIED FARM LAND

CENSUS OF CANADA FIGURES



Logs were cut on the Napanee Watershed and driven down the river each spring for almost a century. The Napanee Express on May 16, 1890, states:

"The water is very low in the river at present and the drivers have considerable difficulty in floating the logs through."

The last log drive came down the Napanee in 1905.

The attitude of the settlers was naturally antagonistic to the forest, because the trees interfered with all their efforts at improvement and the great task of removing them must be accomplished before any new development, whether it be constructing a road, clearing a farm or establishing a townsite, could be undertaken. This inimical view of the forest, along with the idea that the supply was inexhaustible, was so firmly established that it is only in recent years that it has begun to disappear.

Settlement and lumbering were carried on simultaneously in the watershed, the one helping to develop the other as long as the timber lasted. Lumbering provided winter employment for the settlers and a convenient market for hay and other products. As the country was gradually opened up the best land was naturally taken up first.

There are other extensive areas where, due to the rocky nature of the soil, farming could never be attempted, the trees were cut off, and repeated fires have not only prevented natural regeneration but have destroyed the humus itself, and what little soil there was has been washed off the rocks into the depressions.

The rate of the reduction of the forests through lumbering, settlement and fire was very rapid, as is shown by the table which gives the acres and per cent of woodland to cleared land on occupied farms by townships and counties from 1850 to 1940, according to the Census of Canada figures, and this is also shown graphically on the chart. While this does not give the whole picture, it does give an indication of the rate of clearing in the southern part of the watershed.



WOODLAND IN PER CENT AND ACRES OF OCCUPIED FARMLAND  
CENSUS OF CANADA FIGURES

Township	Township Area	Occupied Farmland 1940	1850		1860		1910		1920		1930		1940	
			Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres	Per Cent	Acres
LENNOX AND ADDINGTON COUNTY														
Camden East	84,833	84,833	51	44,507	40	34,553	7	5,937	10	8,879	11	9,393	11	9,541
Ernestown	62,054	62,054	51	33,081	36	24,168	11	7,351	7	4,701	9	6,028	12	7,689
Fredericksburgh	43,259	43,259	44	19,438	32	14,214	16	7,282	9	3,842	10	4,254	9	3,861
Richmond	49,055	49,055	54	27,694	46	23,558	8	4,049	8	4,204	10	5,247	8	4,297
Sheffield	63,884	50,391	28	14,366	43	21,915	17	8,643	19	9,526	21	10,705	12	6,289
Totals	303,085	289,592	48	139,086	41	118,408	11	33,262	11	31,152	12	35,627	11	31,677
FRONTENAC COUNTY														
Bedford	65,950	52,999	28	15,104	37	19,476	11	5,870	11	6,310	12	13,123	25	19,124
Hinchinbrooke	64,584	54,952	11	6,064	17	9,117	6	3,216	17	9,575	26	10,451	16	8,563
Kennebec	43,529	35,847	-	-	16	5,792	22	7,968	36	12,873	19	6,818	20	7,350
Loughborough	58,200	43,113	30	12,969	43	18,725	23	9,860	18	7,707	21	8,912	23	9,810
Portland	52,448	49,208	41	20,139	49	23,982	7	3,539	15	7,346	14	7,115	15	7,510
Totals	284,711	236,119	23	54,276	33	77,092	13	30,453	19	43,811	20	46,419	22	52,357

No figures available for 1870 to 1900



Occupied farm land was 50 per cent cleared in Lennox and Addington in 1850; by 1910 only about 11 per cent remained in woodland and the amount has stayed fairly constant ever since, though the quality has been decreasing steadily due to cutting, grazing and fire.

The above-mentioned tables are most valuable in indicating the rate at which farm land was cleared rather than the rate at which the timber was cut, because they do not cover the extensive non-agricultural areas of the northern part of the watershed, nor do they show areas which have been cleared of all timber of commercial value, leaving only young growth. Also the definition of woodland varied from person to person; for instance, one farmer might consider a certain cut-over area as pasture, while another would call a similar area woodland because considerable reproduction or young growth remained.

The actual measurement of woodland area within the Napanee Watershed covered by the survey made in 1948 shows a total of 58,790 acres or 29 per cent. Nearly all the northern part is repeatedly burned by fire and is continuously severely overgrazed.



## CHAPTER 2

### FOREST PRODUCTS

#### 1. Early Policy

Previous to 1826 the only persons authorized to cut timber on the public lands were the contractors for the Royal Navy, or those holding licences from them, and there was great infringement of the regulations and much illicit trade, but in this year the first steps towards making the forest resources a source of revenue to the Province and "so securing to the public a share of the wealth drawn from the public domain" led to co-operation among the officials and the termination of the contractor's monopoly. "The inauguration of a system under which anyone was at liberty to cut timber on the ungranted lands of the Ottawa lumber region on payment of a fixed scale of rates to the Crown" overcame in large part the annoyance of the people and authorities in the colony against the export of the sound Canadian timber for the British Navy.

#### 2. Masting

The selection of mast timber was made by government agents who went through the forest blazing with a broad arrow - which was the mark of the British Government. As late as 1827, when Peter Robinson was appointed Surveyor-General of His Majesty's Woods and Forests in the Province of Upper Canada, he was instructed "to make a Survey of the Districts where there may be any considerable growth of Masting and other timber fit for the use of His Majesty's Navy".

The mast and spar export to Britain was thriving in the thirties and forties and it was continued intermittently as late as 1855. The British trade dropped off noticeably after 1854 and this may be attributed to the Reciprocity Treaty with the United States in that year, "securing the free exchange of the natural products between Canada and the United States, including 'timber and lumber of all kinds, round, hewed, and



sawed, manufactured in whole or in part'", and the building of railway connections with the United States border cities.

### 3. Squared Timber

The squared timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the thirties.

Squaring timber consisted of selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge", but later, when the best timber had been cut, they were squared with a rounded shoulder, or "wane", which was known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for by the British market.

The timbers were transported by the river, by teams or by railway to the lake and were built into huge rafts. The rafts were assembled at Deseronto and included timber from the Trent and Moira Watersheds as well as from the Napanee. The lumberjacks built shanties on them where they lived during the trip down to the timber coves at Quebec.

### 4. Saw Material

Sawmills played a tremendous part in the lives of the settlers and in the development of the country:

"Wherever a settlement is formed in America a sawmill is very soon after, if not at the same time, erected. The number of sawmills in the British colonies are inconceivable to those who are not familiarized to the rising settlements of new countries.

"A sawmill is in fact a most important establishment. It not only forms a nucleus or centre to a settlement, but a first-rate sawmill with two frames will give employment to four first-rate, four second-rate and two third-rate sawyers, besides a measurer, a blacksmith and from thirty to forty men to prepare the timber required and for other requisite work connected with the establishment; twenty oxen and two horses are also necessary for hauling the timber required to streams and to other places. The boards, deals and scantlings sawed at these mills, excepting such as are required for the use of neighbouring settlers, are rafted down the river for shipping. As fresh



waters change the colour of the deals from their fresh whiteness to a dark gray and, in the eyes of prejudice, depreciate their value, it becomes an object, but one that can only be attended to occasionally to carry them down in bateaux, scows or other timber rafts." \*

From 1800 on the cutting of timber had been one of the most important domestic businesses in most parts of Southern Ontario, and a very considerable business was carried on at Deseronto. Much of the lumber cut on the Napanee was probably trans-shipped or at least cleared at Bath or Picton as Napanee was not a port of entry.

In order to convert logs into boards the first method used was pit-sawing. This was sometimes done on the bank of the river, as such procedure saved the necessity of digging a pit.

The more usual methods of pit-sawing appear to have been the digging of a pit or building of a platform with a simple but firm and strongly constructed framework. In either case the framework was made the right height for one man to stand underneath, while the other man stood above on the platform or astride the log. This hard method of sawing timber was laborious, and twenty-five boards were a heavy day's work for two men; the boards were nearly always one inch thick, with planks two inches, and the occasional flooring of one and a half inches in thickness.

The first power saws were a direct development of the manually operated pit saw. These were called upright or muley saws and consisted of a saw set vertically in a wooden frame and moved up and down by means of a crank connected to the shaft of the water wheel. One of these, known as O'Hara's Mill, is still in a fair state of preservation on a tributary of Madoc Creek about two and a half miles west of the village of Madoc.

The first sawmill on the Napanee was erected at what is now called Thomson's Mills over 165 years ago and is reputed to have been the second sawmill in Upper Canada.

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\* McGregor, John. British America, Vol. II, 1883.



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"In the year 1785 Robert Clark who had completed the Kingston mill removed to the second township and according to instructions received from the Government proceeded to construct a mill upon the Napanee River at the site of the natural falls."

An old map of the area dated 1836 shows two mills in Napanee and nine in other parts of the watershed, including Strathcona, Newburgh, Camden East and Colebrook. In 1860 another map shows 25 mills, two of these very large. The mill at Strathcona, then called "Napanee Mills", turned out nine million board feet of lumber a year and the mill at Thomson's Mills produced three million board feet. Today, with the destruction of the forests, there are only four small mills operating and one of these is a portable mill.

A study of the Census of Canada returns of forest products of farms only, not for the whole of the two counties, as given in the table, reveals the various trends and changes in the lumber industry fairly clearly.

From 1870 to 1890 much of the timber was squared and measured in cubic feet. In 1870 other products listed were pulpwood, firewood, staves, lathwood, tanbark and masts and spars. Between 1880 and 1890 the peak production of nearly all items was reached, and squared pine alone in Lennox and Addington Counties ran to more than 400,000 cubic feet in 1870. In 1890 fence posts and telephone poles were added to the list of products, as were railway ties. In the census years of 1900 and 1910 squared timber was still recorded in cubic feet and logs were measured in board feet; staves, lathwood, masts and spars and tanbark disappeared from production in 1920.

In 1920 too no squared timber is shown and even logs are no longer separated by species. The returns of the latest census covering the year 1940 show only two products of the forest individually and the rest are all listed together as other valued at so many dollars. The one product which has persisted through the records is firewood, which in

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\* Canniff, Wm. The Settlement of Upper Canada, 1869.



Lennox and Addington County has dropped from a peak of 126,281 cords in 1880 to 22,441 cords in 1940.

One or two interesting observations with regard to individual species may also be made. Tamarack was listed in large quantities regularly until 1890 after which it no longer appears, due to the depredations of the larch saw-fly which almost wiped it out at this time. The returns show that some black walnut, butternut and hickory were cut. White pine was, of course, the species most sought after. In 1870 and 1880, pine and oak were the only species which were squared, but as these species became scarce ash, birch, elm and maple were made into square timber.

##### 5. Shingle Making

In the history of roofing used on the Napanee Watershed it is found that the first covering for human habitation on the river was the Indian elm-bark lashed roof. The first type of roof used by the early settlers was made of "scoops" which were flattened logs, usually cedar, six inches thick with one face scooped out to a depth of 1 to 1½ inches. These ran from the peak of the roof to the eaves, being placed alternately so that the one scoop had the scoop side up and the next one the scoop side down, the edges overlapping the scoop below. The second type of wooden covering used by the white man was a rude type of shingle called a "shake". These were made with an axe or frow and were cut from pine or cedar three or more feet in length. Although unshaped they were a great improvement over the bark covering.

Very early in the history of settlement on the Napanee, however, hand-made shingles were introduced. The shingle maker would saw the logs into short lengths or bolts and split them with a frow to the right thickness. The shingle was then fastened by one end in a device called a shingle horse and by means of a heavy drawknife the shingle was tapered to an edge. This method was fast and it has been said that a good



shingle maker would turn out from eighty to a hundred of these hand-made shingles an hour.

There was a concentration of shingle makers around Enterprise in the late 1850's and of "wood and willow ware" specialists at Enterprise about the same date.

In 1857 there were three shingle makers at or near Enterprise and the names suggest that these were separate establishments, since they are those of sawmill owners in the district at later dates (not at Enterprise). One shingle mill is listed in 1865 and one shown (near Carmanville) in 1878. There was a shingle mill at Petworth in 1869, which disappears later, and one in 1887 at Erinsville on the Salmon.

Possibly the supply of good cedar, which must have been abundant, petered out about 1870. Shingle mills in this district are rarely listed after that date, though there were many in other parts of the Province during the last years of the nineteenth century.

Up to the seventies and even later the shingle maker continued to use drawknife and frow, but gradually in the seventies the generation of craftsmen died out and the shingle mill, where shingles were sawn, became the general source of supply.

## 6. Fuel and Ties

From the earliest days of settlement on the Napanee to 1850, wood was the sole source of fuel supply. All species were used for this purpose, including beech and maple - although these were furniture woods as well. With the inception of steamship travel and later the railway, and steam-driven factories, the forests of the area were ruthlessly cut to feed industry.

In the very early days of the steamship, 1832, the Honourable Adam Fergusson writes:

"Wood is furnished upon the St. Lawrence for one dollar, or five shillings per cord while upon the Hudson it now costs three times as much - A man may prepare two cords a day, but it is severe work, and the price, which is one dollar per cord, will do little more than compensate maintenance and labour - and an ordinary steamboat consumes fifty or sixty cords, or about 7,000 cubic feet each trip (from Montreal to Quebec)".



The price of cordwood in 1825 was quoted at \$2.00 a cord.

With the completion of the Grand Trunk between Toronto and Montreal in 1856, locomotive requirements took large quantities of the best body hardwood, chiefly beech and maple.

#### 7. Road Materials and Fencing

In the early days, the making of corduroy roads furnished another important wood use. The Indian trails had followed the ridges and natural conformation of the country, but when the "T-square" roads had been laid out in government offices, they followed the arbitrary lot and concession lines regardless of natural contours. Many of these roads were built through swamps and in these places corduroy construction was used. Many corduroy bridges and culverts were also placed over the river and its tributary streams.

The building of plank roads - a form of highway in which the planks were laid crosswise and side by side - was done in several parts of the Province.

Much wood was also used for fencing and for this cedar from the swamps was most common. The troublesome pine stump also was used for this purpose in many parts of the Province, although in very early times it seems that it was left in the fields. Around 1900 the wire fence came into use generally and thereafter a fence-post industry was developed: these were cut as a rule to a standard length of eight feet, while the diameter varied greatly.

#### 8. Woodworking and Planing Mills

During the early years of settlement in the rural districts and communities, house trim for exterior and interior was made by the same man who constructed the frame of the house. The custom, up to the fifties at least, was for the carpenter to board with the family the winter before the new frame house was to be built and work all his timber into shape by hand, both for the exterior and interior use.



*Big wheels, 6 to 7 feet in diameter and drawn by oxen, were occasionally used for logging on sand plains, the front end of the logs being slung from the axle. This pair, preserved by a local farmer, are the only ones known to exist in Ontario today.*



*A typical sawmill north of Newburgh.*

*Sawmill at Bellock.*





The early carpenter also made door and window frames and all interior trim of the house by hand and, for all these products, pine was the usual type of timber chosen. It would seem that doorsteps were one of the very few things for which oak was used in house building, at least up to the sixties. For example, an old-timer is reported to have said, when asked if they used much oak in the early days, "No, we didn't need to. We had plenty of pine."

Generally, as time passed, the building trades became more differentiated, and more craftsmen settled on the watershed.

After the appearance of the planing mill in the fifties - there was a large steam planing mill at Camden East in 1860 - the end of the hand-made door and window frames was foreshadowed, and much of the general carpenter's work was taken over by mill or factory.

## 9. Wooden Implements and Vehicles

### (a) Early Tools

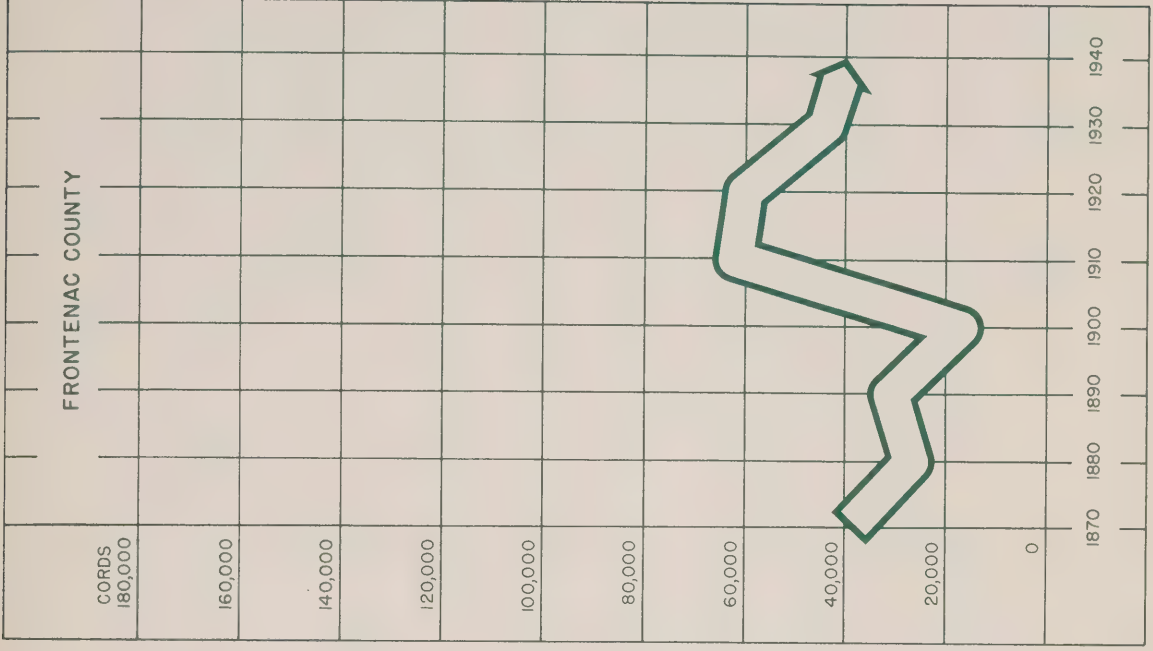
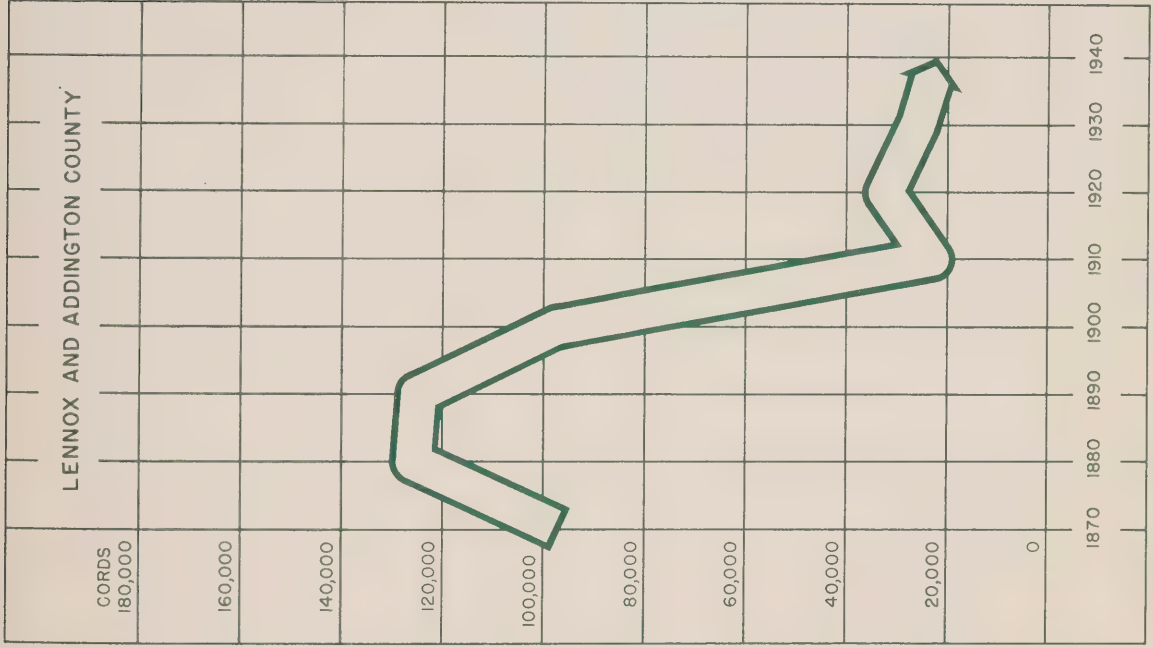
From the very early days, hickory was preferred for the making of axe-helves or handles, while for beams or ox-yokes beech was used extensively and, for the loop, ironwood would probably have been selected. Spike handles were made of rock elm, white ash, hickory or ironwood; the beetle-head (mallet used for pounding hemp and flax) was also made of ash, elm, hickory or ironwood. The hardwoods growing on the watershed were used almost entirely for making handles of implements, whereas pine was preferred for all building operations.

As settlement developed and more craftsmen arrived in the area, the general types of agricultural implements improved and metal replaced wood in large part.

### (b) Vehicles

From early times the making of vehicles progressed as carts, wagons, sleighs and hay and wood racks were built by the farmers. In the building of carts and wagons,





## FUELWOOD PRODUCTION

CENSUS OF CANADA FIGURES



ESTIMATED FROM CENSUS OF CANADA FIGURES  
LENNOX AND ADDINGTON COUNTY

Products	Species	Unit	1870	1880	1890	1900	1910	1920	1930	1940	1950
Pulpwood		Cords			358	365					
Tanbark		"	2,396	2,781	1,246	811	20	347	1,196	908	
Lathwood		"	381	1,216	122						
Masts & Spars		Number	12	27	1,345	1					
Staves		M	31	221	3	\$379	\$218				
Fence Rails		Number									
Fence Posts		"			107,131	92,712	3,879	4,779	4,707		
Poles		"			3,558	1,532	1,763	6,241	5,613		4,077
Railway Ties		"			180,975	182,135	11,614	180	112		132
Shingles		"						300	800		
Piling		"			7,210M						
Fuel Wood		Cords	96,773	126,281		100	8				
Square Timber & Logs	Ash	Cu.ft.			125,358	95,213	23,637	32,521	26,157	22,441	10,784
	Birch & Maple	"	845	8,690		7,579	1,215				
	Black Walnut	"	150			3,850	1,640				
	Butternut	"	150	48,136							
	Elm	"	9,630	38,543	26,043	20,651	16,998				
	Hickory	"	5,710	225	10						
	Oak	"	16,050	47,186	25,172	5,131	4,155				
	Pine	"	437,669	2,300,333	152,369	5,337	1,460				
	Tamarack	"	6,657	53,156	28,519						
	Others	"	126,539	2,428,621	325,880	127,435	2,096				
Lumber	Pine	M.bd.ft.	35,666	36,973	56,741	1,540	208				
	Others	M.bd.ft.	6,858	12,308	48,415	8,911	1,308	879	807		1,080
Other Products		\$						924	178	18,451*	1,150

\* Includes lumber, posts and poles

M = Thousand (1,000)



ESTIMATED FROM CENSUS OF CANADA FIGURES  
FRONTENAC COUNTY

Products	Species	Unit	1870	1880	1890	1900	1910	1920	1930	1940	1950
Pulpwood		Cords			60		339	4,184	4,687	3,215	1,190
Tanbark		"	1,913	517	364		148				
Lathwood		"	100								
Masts & Spars		Number	10	52	12		8				
Staves		M	12				\$472				
Fence Rails		Number						10,562	9,533		
Fence Posts		"			7,051	4,895	27,815	13,046	7,891		14,668
Poles		"				50	2,065	98	1,042		48
Railway Ties		"			1,000		70,750	27,804	10,804		
Shingles		"			263M						
Piling		"					234	10,562	9,533		
Fuel Wood		Cords	38,922	27,231	31,886	17,538	62,653	60,649	44,869	40,322	15,666
Square Timber & Logs	Ash	Cu.ft.				165	2,725				
	Birch & Maple	"	600	385	216		16,025				
	Butternut	"		500							
	Elm	"	5,150	4,764	80	1,749	11,693				
	Hickory	"	584	1,000							
	Oak	"	5,045	3,509	3,759	973					
	Pine	"	6,500	1,692	3,619	2,000	17,746				
Lumber	Tamarack	"	3,200	725	1,000						
	Others	"	39,124	7,708	4,015	563	16,034				
	Pine	M.bd.ft.	712	517	137	73	550	1,948	963		1,468
	Others	M.bd.ft.	993	512	210	285	4,114				
Other Products		\$					10	214	2,135	16,700*	5,992

\* Includes lumber, posts and poles

M = Thousand (1,000)



whiffletrees, wagon-tongues and binding poles were made of rock elm, white ash, hickory and ironwood, as were also sleigh-runners and hay and wood racks. Usually the wheels or runners of these conveyances were bound with iron, although the use of metal was limited in early days, since the supply had to be imported by water. In 1860 there was a hub factory at Newburgh. Until 1929, when the factory burned, motor car wheels were manufactured at Yarker, most of which were supplied to McLaughlin's at Oshawa.

(c) Present Wood Products

Today furniture is manufactured in Napanee by what is said to be the oldest furniture firm in Canada, established in 1835, and there are four manufacturers of small wood products. Brushes are made at Newburgh, clothes driers and boxes at Camden East and toys and crates at Yarker. Wooden pumps are still manufactured at Colebrook by a firm which began operations in 1870.

10. Indirect Products and By-Products

The three indirect products of greatest importance were maple sugar, lye and tanbark. Maple sugar furnished the staple sugar for the pioneers - cane sugar not, at that time, having been procurable; lye or potash was used domestically in making soft soap - almost the universal soap; tanbark was utilized in dressing leather by the shoemakers.

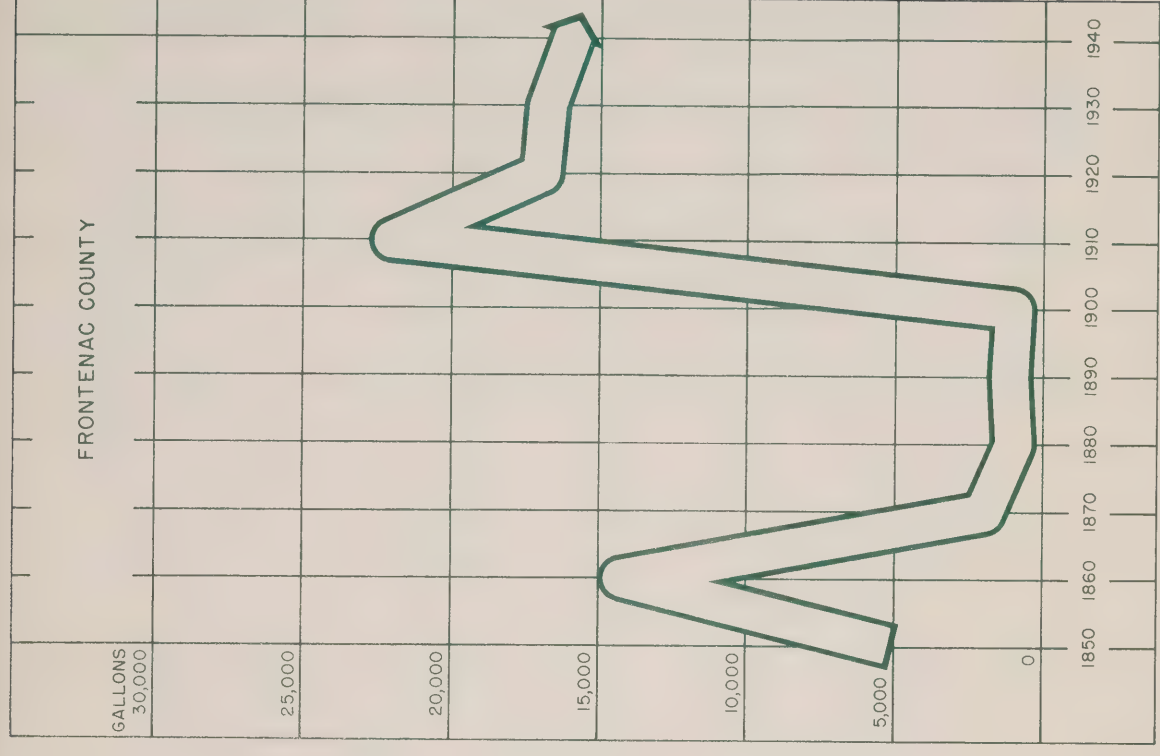
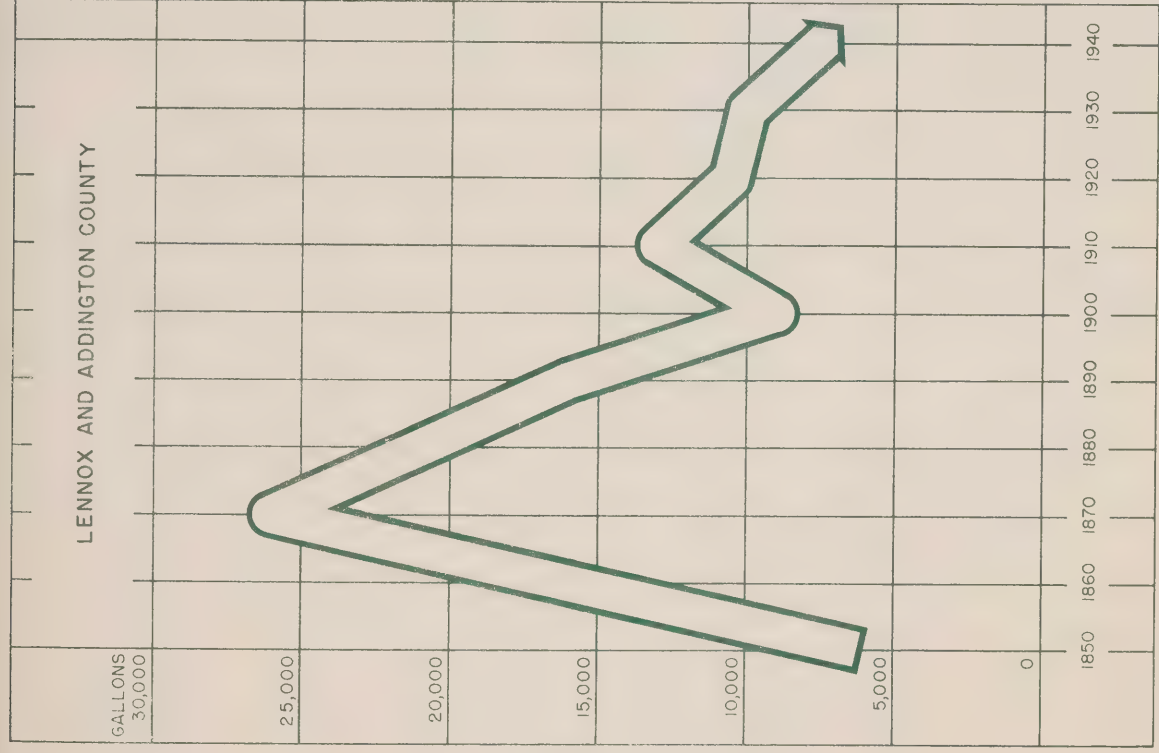
(a) Potash

The ashery played an important role in the drama of pioneering life; and besides communal asheries, the individual ash house and the ash barrel on a platform for leaching was characteristic of each farm, in the days before the soap manufactory came into being. In 1860 there were two potasheries at Newburgh.

(b) Maple Sugar

The table shows the Census of Canada figures for maple products in the counties of the watershed. It is





## MAPLE SYRUP PRODUCTION

CENSUS OF CANADA FIGURES



CENSUS OF CANADA FIGURES

(As reported)

County	1850	1860	1870	1880	1890	1900	1910		1920		1930		1940	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.
Lennox and Addington	62,683	158,046	258,192	217,665	165,384	93,455	6,943	12,395	2,106	10,328	743	9,810	633	7,457
Frontenac	49,836	139,329	18,824	11,074	13,756	11,218	9,843	21,062	11,022	15,612	1,813	16,481	664	15,752

\*(As syrup equivalent)

County	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.	Gals.
Lennox and Addington	6,268	15,805	25,819	21,767	16,539	9,345	12,889	10,539	9,884	7,520				
Frontenac	4,934	13,933	1,882	1,107	1,376	1,122	22,046	16,714	16,662	15,818				

\* For purposes of comparison, the pounds of sugar figures in the top half of the table have been converted to their syrup equivalents in gallons and added to the syrup figures.



interesting to note that up to 1910 production is all recorded as pounds of sugar, from 1910 on both pounds of sugar and gallons of syrup were shown, indicating the change from a pioneer necessity to the modern luxury. For purposes of comparison the sugar figures have been converted to their syrup equivalents and from these, shown in the second table, it will be seen that production in Lennox and Addington dropped steadily from the peak of nearly 26,000 in 1870 to less than 8,000 in 1940.



## CHAPTER 3

### PRESENT WOODLAND CONDITIONS

#### 1. The Laurentian Shield (Rock Knob Uplands)

With the exception of lakes, marshes and limited areas which have been cleared for agricultural purposes, the whole of Sheffield, Hinchinbrooke and the north half of Portland Townships are potential forest land. This is the typical rock knob country of the Laurentian Shield with elevations ranging from 500 feet above sea level in the south to the extreme elevation of 825 feet in the south-east corner of Kennebec Township. The country slopes generally from north to south and consists of innumerable low rounded hills with countless small swamps and marshes between them. The depth of till varies from nothing over extensive areas where it has been washed off the rock following logging, fire and grazing to a few feet where the ablation moraine provides a thin layer of coarse-textured soil.

This area has no form of fire protection whatever and fires occur every few years which burn for days completely unattended, no effort being made to extinguish them. It is urged most strongly that the Authority request the Provincial Government to include Kennebec, Sheffield, Hinchinbrooke, Loughborough and Portland Townships in the Quinte District with headquarters at Tweed.

It has been shown that the Quinte District, due to the greater number of people, has the highest incidence of small fires of any district in Ontario, but this was offset many times over by the increased efficiency in handling fires in the early stages, made possible by quick detection and easy access to them with men and equipment.\* This is a convincing argument for fire protection in the area adjacent to the district where the number of people is large and access to the area is

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\* Report of the Ontario Royal Commission on Forestry, 1947.



good. Further, Highway No. 7 passes right through this region to the north of the Napanee Watershed. This not only means that the fire risk is increased but that large numbers of people see these barren burned areas every year and carry away with them a very poor impression of Ontario's fire protective methods.

As a matter of fact, the Royal Commission's Report goes on to say that

"Fire protection is entirely inadequate in the areas adjacent to but outside those protected by the Department of Lands and Forests. Local municipal employees rarely have much knowledge of methods to be employed in fighting fire and, in any event, the necessary equipment is generally lacking.

"I recommend that the Department of Lands and Forests be empowered to enter into agreements with adjacent municipalities to protect their forests at a fee commensurate with that paid by limit holders."

The benefit of fire protection is particularly noticeable as one travels northward on Highway No. 41 from Kaladar. As one approaches the south boundary of the fire district the condition of the woods improves until the protected area is reached where thrifty stands indicate the value of the thirty years of fire protection which they have enjoyed.

Another factor which is helping to create and maintain what are becoming almost desert conditions over the northern part of the watershed are the large numbers of cattle which are permitted to range at will over the extensive unfenced areas of this northern section. In some instances the cattle are put out in the spring and run wild until fall, devouring all reproduction and young tree growth.

The forests of the northern portion of the watershed were originally a mixed forest of sugar maple, beech, yellow birch, hemlock and white pine. In addition, there were varying amounts of basswood, white spruce, balsam, red oak, elm, white ash, red maple, ironwood, white birch and poplar. White pine originally constituted a high proportion of the stand and red pine was also probably a fairly prominent species. Today the



bush consists mostly of young growth and second growth poplar stands which have come in following fire and scrub oak which has survived the fire. Throughout the area there is a scattered growth of white pine on the well drained soils and the depressions support swamp species such as black ash, white elm, silver maple, tamarack, black spruce and balsam.

## 2. The Limestone Plain

South of the Laurentian Shield and south of the great swamp which bisects the watershed east from Enterprise, the watershed lies for the most part on the limestone plain. The exception is the narrow fertile valley of the Napanee River which has been cut into the plain. On the plain itself the soil is shallow, varying from no soil cover to depths which make agriculture possible. Over large areas the tree cover has been removed, the land has been severely overgrazed and the shallow soil depleted of humus and, exposed to beating rains, has been washed away into crevices. Wherever trees can, they put their roots down into these crevices and may develop quite thriftily. Such species as sugar maple, basswood, rock elm, white pine, white spruce and white cedar do quite well under such conditions.

The restoration of forest cover and duff to these areas presents certain difficulties but is essential to the maintenance of stream flow.

## 3. Survey Methods

Field mapping was done on aerial photographs which were on a scale of 1,000 feet to the inch and each photograph covered an area of approximately 1,000 acres, usually a block lying between two adjacent concession roads and two adjacent side roads.

Every area of woodland, brushland, marsh, swamp and rough land was visited and notes made describing it. In the case of woodlots and plantations, detailed notes were made





*Chestnut oak is a rare tree in Ontario but a few trees may be found growing naturally in Fredericksburgh Township.*



of their condition. Overgrazed woodlots and woodlots with very scattered trees which could be restored were classified as woodland. In short, where doubt existed as to whether an area should be classified as woodland or not, woodland was given the benefit of the doubt.

All woodlots were grouped according to the following classification:

<u>Mature</u>	<u>Hardwood</u>	<u>Mixed Wood</u>	<u>Coniferous</u>
Virgin	H-1	M-1	C-1
Moderately culled	H-2	M-2	C-2
Severely culled	H-3	M-3	C-3
<u>Immature</u>			
Second growth	H-4	M-4	C-4
Young growth	H-5	M-5	C-5

In this classification the term "hardwood" is used to denote all broad-leaved trees irrespective of whether the wood is physically hard or not. A hardwood type is one in which 80 per cent or more of the stand is composed of hardwood trees, a coniferous type is one in which 80 per cent of the stand is composed of coniferous trees and a mixed stand embraces all others.

Mature stands are those which have reached commercial maturity and are separated into three groups, namely those which have had practically no cutting done in them, which are termed virgin stands; those which have been moderately logged, usually under some form of selective logging; and those which have been severely culled where, as a rule, only large, defective trees remain. Immature stands are those in which the trees have not reached commercial maturity and these are subdivided into two groups, namely those in which the trees are over four inches in diameter at breast height which are designated as second growth stands and those in which the trees are under four inches in diameter which are termed young growth.

Stands were also grouped according to forest cover types. See accompanying table, the description of forest types, and map folded at the end of this report.



Where plantations were encountered records were made of planting, care, damage and survival.

#### 4. Forest Cover Types

The Napanee Watershed lies partly within the Huron-Ontario and partly within the Algonquin Laurentides Sections of the Great Lakes - St. Lawrence Forest Region.\* The line separating these two regions is the edge of the Laurentian Shield.

In the Huron - Ontario Section, that is the southern portion on the limestone plain, sugar maple and beech are the dominant species and associated with them are basswood, white elm, yellow birch, white ash, red maple and red, white and bur oak. Groups of hemlock, balsam fir and white pine occur within the association as well as scattered aspen, bitternut hickory, butternut, ironwood and black cherry. Blue beech, silver maple, slippery and rock elm and black ash are found on specialized sites such as bottom lands and swamps. White pine is found on the lighter soils, red cedar is present on the limestone soils and white cedar in swampy depressions.

In the Algonquin - Laurentides Section, the northern part of the watershed on the Shield, white pine was originally abundant. Because of cutting and fire very little now remains and there is a secondary association of aspen, large-toothed aspen, balsam fir, white spruce, white pine and scattered soft maple, red oak and ironwood. In addition to the above there are areas of pure hardwoods with a dominance of sugar maple; white and bur oak commonly occur and swamps of red maple, black ash or white cedar occupy the depressions.

In making the survey of the woodlots no attempt has been made to classify them according to forest types.

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\* Halliday, W.E.D. A Forest Classification for Canada, Dominion Forest Service Bulletin 89. 1937.



Forest cover types only have been used and are defined as being\* "a forest type now occupying the ground - no implication being conveyed as to whether it is temporary or permanent".

A forest cover type may be either temporary or permanent; for example, the present stand may be aspen which has seeded in the area following fire. Aspen seed is light like dandelion seed and is carried easily by the wind, thus it quickly covers large areas, also it is not exacting in its soil requirements and may be the only species which will grow under the soil conditions existing at the time. The fact of its growing and dropping its leaves on the ground gradually improves the condition of the soil so that more exacting species can grow. In addition its light shade frequently provides the correct light conditions for better species to get a start. As it is a short-lived tree, it will die early and the other species will dominate the area. This succession may be carried through two or more stages until the species best suited to the area or best able to maintain itself on the area takes over, and this is called the forest type or climax type, as distinguished from the forest cover type which is the type occupying the ground at the present time. The commonest forest type on the Napanee Watershed is white elm - silver maple.

No classification of forest cover types has been made in Canada for Southern Ontario so the system used is a slightly modified form of that drawn up by the Society of American Foresters, which covers the whole of the eastern United States; consequently there are many types in their classification which do not enter Canada and this accounts for the gaps in the numerical listing of types occurring in the Napanee Watershed. The forest cover types of the Napanee Watershed may be listed as follows:

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\* Forest Cover Types of the Eastern United States - Report of the Committee on Forest Types, Society of American Foresters, 1940.



<u>Number</u>	<u>Name</u>
4	Aspen
4A	Poplar - oak
6	Paper birch
8	White pine - red oak - white ash
9	White pine
10	White pine - hemlock
11	Hemlock
13	Sugar maple - basswood
14	Sugar maple
21	White spruce - balsam fir - paper birch
23	Black spruce
24	White cedar
26	Black ash - white elm - red maple
45	Bur oak
46	Red cedar
49	White oak - (black oak) - red oak
51	Red oak - basswood - white ash
52	Red oak
57	Beech - sugar maple
59	Ash - hickory
60	Silver maple - white elm
60A	White elm

#### Type 4 Aspen

Aspen is a pioneer type coming in after fire or over-grazing. Though it avoids the wettest swamps, it does grow on soils that are wet throughout a good part of the year as well as on dry soils. Its associates may be white elm, paper birch, red cherry and balsam poplar with occasionally large-toothed aspen and green ash. It forms over 3 per cent of the woodland in the northern and 1 per cent in the southern part of the watershed, mostly on neglected pasture lands of rock, sand, silt or muck.

#### Type 4A Poplar - Oak

This is a residual type on rocky land following logging and fire. The oak usually consists of trees of white, red and sometimes bur oak which have survived due to their resistance to fire, and poplar, either trembling or large-toothed which has seeded in later. The site is usually a white pine site and scattered trees of this species frequently occur with patches of good white pine reproduction appearing through the area. It comprises nearly 50 per cent of the woodland on the Shield.

#### Type 6 Paper Birch

This is also a pioneer type of clear-cut and pastured areas succeeded by other northern hardwood types or



white pine. Its associates include small proportions of aspen, white pine, hemlock, red maple, red oak and basswood. Frequently an understory of conifers or tolerant hardwoods develops. It is almost non-existent in the Napanee drainage basin, but 47 acres occur in Bedford Township.

Type 8 White Pine - Red Oak - White Ash

This type is not extensive but 79 acres were mapped in Bedford Township. Its chief associate is red maple, but other common ones are basswood, yellow birch, large-tooth aspen, sugar maple, beech, paper birch and black cherry.

Type 9 White Pine

White pine typically occurs on fresh, sandy loam upland but also on clay, in swampy areas and on loamy sand. On sandy soils it tends to be permanent but on heavier soils it is usually succeeded by sugar maple - beech, red oak - basswood - white ash, white pine - red oak - white ash, white pine - hemlock, sugar maple - basswood, white oak or white spruce - balsam fir - paper birch.

Its associates on light soils are aspen, red maple, pin cherry and white oak, on heavier soils yellow birch, black cherry, white ash, red oak, sugar maple, basswood and hemlock. It was originally abundant on the watershed but now occupies less than 2 per cent of the wooded area.

Type 10 White Pine - Hemlock

Associated with this type are many species but none is particularly characteristic. The principal ones are beech, sugar maple, basswood, red maple, yellow birch, black cherry, white ash, paper birch and red oak. It occurs on a range of sites from sand plains to heavy upland soils, but favours cool locations such as the slopes of ravines. It is almost negligible in the Napanee Watershed.

Type 11 Hemlock

This type occurs mostly in widely scattered bodies in cool locations, moist ravines and north slopes,



frequently in the sugar maple - beech type. Its associates are beech, sugar maple, yellow birch, basswood, red maple, black cherry, white ash, white pine, paper birch and red oak. A very few acres are present on the Napanee area.

Type 13 Sugar Maple - Basswood

This is a fairly important type occurring on loamy upland soils. Its associates are white elm, green ash, yellow birch, white pine and red oak with ironwood and blue beech as subordinates. It forms  $2\frac{1}{2}$  per cent of the woodland on the Shield and almost 4 per cent of that on the limestone plain.

Type 14 Sugar Maple

This type undoubtedly originally covered the greatest part of the southern portion of the watershed but since it occupied fertile, well-drained soil with good moisture much of it has been cleared for agriculture. A small proportion of other species such as yellow birch, white ash, red and white oak may be present. Today it covers over 3 per cent of the wooded area of the Shield and over 13 per cent of that of the limestone plain.

Type 21 White Spruce - Balsam Fir - Paper Birch

White spruce and balsam fir are the key species of this mixture though they do not always predominate. Aspen, white pine, white cedar, sugar maple, green ash and yellow birch may also occur. It comprises over 2 per cent of the present woodland in the southern section.

Type 23 Black Spruce

Black spruce as a pure type occurs on acid peat in swamps with little or no drainage. It may be mixed with minor quantities of balsam fir, tamarack, white cedar, black ash, red maple and paper birch. It comprises only 1 per cent of the woodland.

Type 24 White Cedar

The associates of this type are tamarack, yellow birch, paper birch, black ash, red maple, white pine and hemlock.



It occurs on sites of slow drainage which are not strongly acid including the muck soils of the watershed, and is also present on poor pasture land and bottom land, particularly on limestone. It forms over 10 per cent of the woodland in the southern section and is the chief source of fence posts and poles.

Type 26 Black Ash - White Elm - Red Maple

This type occupies moist to wet soils in swamps, gullies and small depressions. Its associates are balsam poplar, yellow birch with sometimes white pine, tamarack, white cedar, basswood and bur oak. It comprises over 11 per cent of the woodland of the Shield.

Type 45 Bur Oak

This is an uncommon type in Ontario, the associates of which are red oak, white oak or black oak, and occurs on loamy slopes with south or south-west exposures. Only 111 acres are present on the Napanee Watershed, all of which are in the southern section.

Type 46 Red Cedar

Red cedar normally occurs on limestone soils or dry uplands, associated with white oak and white elm or red maple and aspen. In the Napanee Watershed it is found only in Fredericksburgh and Richmond Townships, where it is invading pasture fields on limestone outcrops, as cattle will not browse on it. It comprises about 106 acres in all.

Type 49 White Oak - (Black Oak) - Red Oak

The mixed oak type occurs on 1,029 acres, mainly on the drier soils on the Shield. In areas such as the Napanee Watershed, which are north of its main range, the type does not correspond exactly to its name, and black oak is usually absent.

Type 51 Red Oak - Basswood - White Ash

Associated with the type species are red maple, yellow birch, aspen, sugar maple, paper birch and beech on less well-drained soils. This is not a very important type, there being only 634 acres in the watershed, all of which occur on the Shield.

Type 52 Red Oak

Red oak may be pure or associated with white oak on ridges in park-like stands. The trees are short-trunked and





*Sugar maple and beech forests covered much of the southern portion of the Napanee Watershed, but few trees remain as large as these in a farm woodlot east of Moscow.*



flat-topped. About 75 acres occur in the north section of the watershed.

Type 57 Beech - Sugar Maple

This is regarded as the typical association of the climax with red maple, white oak, red oak, hemlock, white elm, red elm, basswood, shagbark hickory and black cherry. This type was undoubtedly fairly extensive in the Napanee Watershed, but, because it occupied the best land, its area has been tremendously depleted and it now comprises about 300 acres of the remaining woodland.

Type 59 Ash - Hickory

This type is not listed in the American classification but has been introduced because of its frequent occurrence in the south part of the Napanee Watershed. It is usually a residual type following cutting, often of Type 60 silver maple - elm, though it may occur on any poorly-drained, cut-over area. It is usually composed of a mixture of white, green or red ash and shagbark and bitternut hickory with bur oak, cottonwood, blue beech and ironwood as associates. It constitutes 2 per cent of the woodland in the southern section.

Type 60 Silver Maple - White Elm

This is a type of flood plains and poorly-drained soils unsuitable for general farming unless completely and adequately underdrained; for this reason it and the similar white elm type 60A have survived better than forest cover types on better drained land. Associated species are red maple, slippery elm, cottonwood, white, red and green ash, bur oak and bitternut hickory. This type represents almost 20 per cent of the woodland of the watershed, much of it occurring in the great hardwood swamp east of Enterprise.

Type 60A White Elm

Type 60A is very similar to the silver maple - white elm type 60, but is found on drier sites as well as swamps and swales and its associated species are the same. It is not listed in the American classification but has been introduced here because of its frequent occurrence in Southern Ontario. It comprises over 14 per cent of the woodland so that



Township	No. of Acres	4	4A	6	8	9	10	11	13	14	21	23	24	26	45	46	49	51	52	57	59	60	60A
Bedford	3,726	45	1,344	47	79	79	-	-	124	736	-	-	86	662	-	-	326	30	-	31	-	94	43
Camden E	7,974	75	-	-	-	124	22	10	222	909	174	-	679	158	71	-	-	-	-	26	135	4,128	1,241
Ernestown	375	18	-	-	-	10	-	-	-	42	-	-	106	-	-	-	-	-	-	-	18	105	76
Fredericks- burgh N.	211	3	-	-	-	3	-	-	2	4	-	-	-	-	-	97	-	-	-	5	2	26	69
Hinchin- brooke	25,351	373	16,832	-	-	277	22	32	719	354	-	14	60	3,392	-	-	471	259	-	241	-	1,659	646
Kennebec	1,167	-	907	-	-	-	-	-	-	-	-	-	-	240	-	-	-	-	-	-	-	-	20
Lough- borough	591	40	226	-	-	-	-	-	57	121	-	-	-	76	-	-	-	-	-	-	-	49	22
Portland	9,322	769	793	-	-	140	-	11	379	766	7	63	232	428	21	-	46	199	75	65	3	4,775	550
Richmond	211	16	-	-	-	-	-	4	6	53	13	-	3	7	19	9	6	-	-	15	-	15	45
Sheffield	9,862	422	6,630	-	-	17	-	-	147	20	-	19	6	1,267	-	-	180	146	-	-	-	819	189
Total	58,790	1,761	26,732	47	79	650	44	57	1,656	3,005	194	96	1,172	6,230	111	106	1,029	634	75	383	158	11,670	2,901
Per Cent	100.0	3.0	45.5	0.1	0.1	1.1	0.1	0.1	2.8	5.1	0.3	0.2	2.0	10.6	0.2	0.2	1.7	1.1	0.1	0.6	0.3	19.9	4.9



## 1948





these two types together make up over 24 per cent of the total woods in the watershed.

The large map shows the distribution of these types throughout the watershed and from it the following observations may be made.

(a) Elm swamp types which covered large areas in the aggregate between ridges and in the glacial drainage channels have survived pretty well throughout the watershed.

(b) Cedar swamps which were scattered throughout the area have maintained their types well but have been severely overcut and pastured.

(c) Sugar maple types are still found scattered throughout the watershed.

(d) The chief pioneer types following cutting and pasturing are aspen types 4 and 4A which cover large areas, particularly on the Shield.

##### 5. Present Conditions

The results of the forest surveys are summarized in the accompanying table.

Woodland on the watershed comprises 58,790 acres, which is 29 per cent of the total area of 201,946 acres. The total number of woodlots examined was 1,820 which includes many areas which are considered by their owners as constituting a single woodlot but which, because of the difference in types and age classes of certain sections, had to be considered in the field as separate units. Conversely, where property boundaries were not marked, woodland extending across two or more properties was often considered as a unit because the type and age class remained constant throughout.

The conifers occurring in the watershed are white pine, hemlock, white and black spruce, white cedar, tamarack, balsam and red cedar. Red cedar is confined to the extreme south end of the watershed as a very small tree. White pine is fairly generally scattered throughout the watershed. Hemlock is found



## WOODLAND CLASS

Township	No. of Woodlots	No. of Acres	Woodland Class						
			H3	H4	H5	M4	M5	C4	C5
Bedford	133	3,726		3,262	249	123	43	36	13
Camden E.	514	7,974		5,944	583	663	179	509	96
Ernestown	40	375		167	71	23	9	72	33
Fredericksburgh N.	31	211		23	79	-	58	3	48
Hinchinbrooke	455	25,351		16,727	7,341	716	471	73	23
Kennebec	10	1,167		1,089	78	-	-	-	-
Loughborough	18	591		572	14	5	-	-	-
Portland	424	9,322		7,213	1,351	551	29	96	82
Richmond	38	211	15	139	28	-	3	14	12
Sheffield	157	9,862		6,860	2,838	137	-	8	19
Total	1,820	58,790	15	41,996	12,632	2,218	792	811	326
			Total Hardwood	54,643		Total Mixedwood	3,010	Total Coniferous	1,137
Per Cent		100.0	-	71.4	21.5	3.8	1.3	1.4	0.6
			Total Hardwood	92.9		Total Mixedwood	5.1	Total Coniferous	2.0



mixed with hardwoods and white cedar and tamarack are present in many of the swamps. There is no doubt that conifers formed a larger part of the woodland than they do today, but their numbers have been diminished because of the desirability of the lumber they furnish and in the northern areas recurrent fires have destroyed them while more fire-resistant species such as oak have survived. The situation at the present time is that of the 58,790 acres of woodland 93 per cent is classified as pure hardwoods, 5 per cent as mixed woods and 2 per cent is classified as pure conifers. Of the hardwoods 71 per cent is second growth approaching commercial size and 22 per cent is young growth under four inches in diameter at breast height.

In the mixed wood classes 4 per cent of the woodland is of the second growth class while 1 per cent is young growth. In the coniferous woods 1.4 per cent is young growth and 0.6 per cent is second growth.

For the whole area the percentage of uneven-aged stands is considerably more than the even-aged, the figures being 84 per cent of the former and 16 per cent of the latter.

Grazing in farm woodlots is very general, the percentage of grazed woodland to ungrazed being 71 per cent for the whole watershed. This is an indication of the low value which the average landowner places on his woodland as a permanent crop. Grazing, as is well known, is detrimental to the proper development of any area. The number of cattle and the size of the woodlot have a direct relationship to the damage which is done. For example, a large woodlot is not as seriously affected by a few head of cattle as a small one, but on most farms the woodlot is small and is seriously damaged by large herds. Grazing in a woodlot destroys young growth, open areas appear and become covered with grass, which means that the maintenance of the forest floor, which is so important to the health of the stand, is interfered with and there is less likelihood of a renewing of the stand by reseeding from old trees. These in turn become stag-headed and are easily preyed upon by fungus and disease.



WOODLAND CONDITION (ACRES)

Township	Acres	Aged		Grazed		Fenced		Reproduction			
		Even	Uneven	Yes	No	Yes	No	Excel- lent	Good	Fair	Poor
Bedford	3,726	598	3,128	3,205	521	-	3,726	-	338	3,110	278
Camden East	7,974	1,182	6,792	6,012	1,962	-	7,974	-	80	6,682	1,212
Ernestown	7,375	1,118	257	369	6	-	7,375	-	12	210	153
Fredericksburgh N.	211	36	175	189	22	-	211	-	-	108	103
Hinchenbrooke	25,351	2,316	23,035	17,468	7,883	5	25,345	48	386	23,595	1,322
Kennebec	1,167	226	941	-	1,167	-	1,167	-	687	480	-
Loughborough	591	11	580	587	4	-	591	-	52	533	6
Portland	9,322	3,303	6,019	5,638	3,684	-	9,322	-	95	8,108	1,119
Richmond	211	130	81	171	40	2	209	-	-	100	111
Sheffield	9,862	1,707	8,155	7,935	1,927	-	9,862	-	15	9,466	381
Total	58,790	9,627	49,163	41,574	17,216	7	58,783	48	1,665	52,392	4,685
Per Cent	100	16.4	83.6	70.6	29.4	-	100	0.1	2.8	89.1	8.0



Fire is a serious factor menacing woodlands in the watershed. It is not necessary to burn a tree to kill it; merely raising the temperature of the growing layer inside the bark to 150 degrees Fahrenheit will do the job and this is frequently what happens.

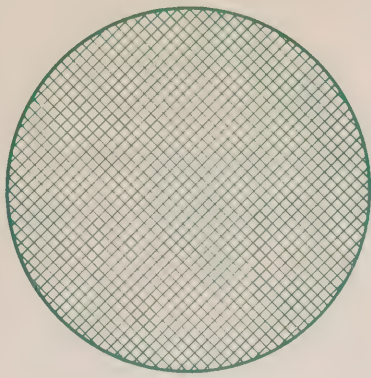
Fire protection is an absolute essential for the proper management of woodland in the watershed. It is recommended that when the Napanee Forest is established, fire-fighting equipment and sufficient personnel be provided to patrol the forest and fight fire when it occurs anywhere in the watershed.

Cutting in woodlots and clean-cutting of whole areas has been carried on persistently in recent years; many acres being sold for cordwood, and in other areas where white pine is found it is being cut into sawlogs of small sizes.

To sum up, 76 per cent of the woods are second growth and 24 per cent are young growth, the former ranging from thirty to fifty feet in height. The few lots containing the largest trees are composed of old hardwoods, elm, soft maple in the swamp areas and sugar maple, beech and basswood on dry sites.

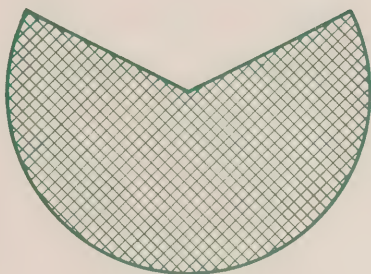
From the foregoing it will be seen that the wooded areas of the watershed are extensive, comprising some 58,790 acres, and are worth preserving and improving. No systematic method of cutting has been used in the past, no attempt has been made to combat fire and none of the woodland is fenced from cattle.





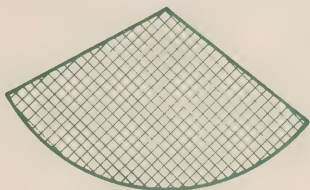
## TOTAL AREA OF WATERSHED

201,946 Acres  
( 100 % )



## OPEN LAND

128,233 Acres  
( 63.5 % )



## WOODLAND

58,790 Acres  
( 29.1 % )



## LAKES AND MARSH

11,936 Acres  
( 5.9 % )



## SCRUB

2,987 Acres  
( 1.5 % )



## CHAPTER 4

### FOREST CONSERVATION MEASURES IN PROGRESS

Very few watersheds in Southern Ontario have such a high proportion of potential forest land as the Napanee and yet little or nothing has been done either to preserve what woods there are or restore trees to the denuded areas. For example, there is no fire protection of any kind, there are no county forests, no demonstration woodlots; only two small township plantations and two small private plantations.

For some years now, the Department of Lands and Forests has divided Southern Ontario into zones, each with its "Zone Forester" whose duty it is to give advice and assistance to private individuals and municipalities on the management of their woodlands and the establishment of plantations. The Napanee Watershed is included in the zone covered by the office at Napanee. Citizens and municipalities would be well advised to make more use of these services.

The nearest forest tree nursery to the Napanee Watershed is that at Orono, in Durham County, which was established in 1922 and has served as the production and distribution centre for trees in eastern Ontario ever since. In addition, it contains a number of excellent demonstrations of forest planting of different species and mixtures.

#### 1. Private Planting

The free distribution of trees for planting was first begun in Ontario in 1905, and the following year a statute was passed which enabled a township council to exempt a part of the woodland of a farm from taxation; it provided that:

"Any part of a farm used for forestry purposes or being 'Woodlands'; provided that such exemption shall not be greater than one acre in ten acres of such farm and not more than twenty acres held under a single ownership.

" 'Woodlands' for the purpose of this paragraph shall mean lands having not less than four hundred



trees per acre of all sizes, or three hundred trees, measuring over two inches in diameter, or two hundred, measuring over five inches in diameter (all such measurements to be taken at four and one-half feet from the ground) of one or more of the following kinds: White or Norway pine, white or Norway spruce, hemlock, tamarack, oak, ash, elm, hickory, basswood, tulip, (white wood); black cherry, walnut, butternut, chestnut, hard maple, soft maple, cedar, sycamore, beech, black locust, or catalpa, or any other variety which may be designated by Order-in-Council, and which said lands have been set apart by the owner with the object solely of fostering the growth of the trees thereon and which are not used for grazing livestock." - R.S.O. 1950, c. 24, s. 5 (18).

In 1927 the exemption of taxation on woodland was made compulsory if applied for, and is interpreted as meaning planted as well as natural trees.

In 1938 The Assessment Act was amended to prevent assessment being raised on land after it had been reforested and now reads as follows:

"Land which has been planted for forestation or reforestation purposes shall not be assessed at a greater value by reason only of such planting." - The Assessment Act, R.S.O. 1950, c. 24, s. 33 (12).

Both these Acts were designed to facilitate the planting of trees on private land and should be taken advantage of by citizens anxious to improve woodland conditions on their own property, and at the same time benefit the whole community of the river valley.

There are only two small private plantations comprising 8 acres in all.

## 2. County Forests

### (a) History and Method of Establishment

The County of Hastings was the first in the Province to interest itself in reforestation and as long ago as 1911 appointed a reforestation committee which was instrumental in having The Counties Reforestation Act passed. The committee also recommended\* that "The Corporation of the County of Hastings purchase from the municipality of the Townships of Elzevir and Grimsthorpe certain lands containing

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\*Minutes of the meeting of the Council of the County of Hastings, December 8, 1911.



2,800 acres more or less for \$200.00" as the nucleus of a county forest. However, no further action was taken and the Act lay dormant till 1922 when the present policy of county forests was laid down. This work is done now under the authority of The Trees Act (R.S.O. 1950, c. 399), which provides for the purchasing of land and the entering into agreements by the county for the management of such lands. No limit as to the size of the area is stated, so that some counties have plots of a few acres, while others have forests of several thousand acres. If, however, a county wishes to enter into an agreement with the Minister of Lands and Forests for the planting and management of such county-owned land, it is preferred that the county purchase not less than one thousand acres. The agreements which are in force at the present time run for a period of thirty years, during which time the Ontario Government agrees to establish the forest, and pay the cost of such items as fencing, buildings, equipment, labour maintenance, trees, etc., in short, everything connected with the management of the forest.

At the end of the thirty-year period, the county has the privilege of exercising one of three options: First, to take the forest over from the Government and pay back the cost of establishment and maintenance; second, to relinquish all claim to the forest, whereupon the Government will pay to the county the cost of the land, without interest; third, the forest may be carried on as a joint undertaking by the Province and the county, each sharing half of the cost and half the profits.

By the time the period of agreement has elapsed, the revenue derived from the sale of thinnings and improvement cuttings, including such products as pulpwood, pit props, posts, ties and poles, will more than equal the original cost of the land in most cases, so that the chance that the County or Authority will have to pay anything even if they decide to take the first option is very slight indeed.



It will be seen from the above summary of the agreement that all a county stands to lose on such a project is the interest for thirty years on the purchase price of the land. Also, it should be pointed out that, in drawing up such a liberal scheme, it was done purposely to encourage the reforestation of land not suited to agriculture. Again, it was not the intention of the Government to have the counties stop at a minimum of 1,000 acres, as the overhead necessary on an area of this size could very easily be spread over an area of five or even ten times the size. As a matter of fact this is what happened in some counties where the councils have initiated a progressive reforestation policy.

This Act also provides that municipal councils of townships shall have all the powers, privileges and authority conferred on councils of counties, except that instead of issuing debentures to an amount not exceeding \$25,000, they shall have power to levy, by special rate, a sum not exceeding \$1,000 in any year for the purpose of providing for the purchase of land for planting and protecting the timber thereon.

The agreements which, up to 1956, have been drawn up between twelve Conservation Authorities and the Ontario Government to establish and manage their forests are substantially the same as those made with the counties, except that the Government has agreed to advance half the cost of all land purchased for the forest, and the agreement for planting and management is to run for approximately 50 years. Authority lands are subject to municipal taxes. The Napanee Authority has acquired 4,379 acres.

Lennox and Addington County purchased three blocks totalling 500 acres along the Old Finton Road in 1948-49. The trees are growing well and serve as a small beginning of a county forest, but none of it lies within the Napanee Watershed. There are many hundreds of acres of land in this county as well as in Frontenac which should be planted with trees and in addition there are many thousands of acres of natural woodland which should be under management.



(b) Financial Returns from Reforestation\*

In addition to indirect benefits such as ground-water supplies, amelioration of floods, wildlife protection and other influences, reforestation has definite financial returns. In support of this the following data are submitted, based on studies of reforestation areas in Southern Ontario, some of which are 40 years of age. Red pine is used as an example because it thrives on sandy soils, has few serious insect and disease enemies, and has splendid marketing possibilities during the early years of rotation in the form of poles and pulpwood. The data here given are based on an area of at least 1,000 acres, which allows for sufficient spread for supervision. Furthermore, it should be pointed out that over the years there has been a considerable fluctuation in the cost of planting, price of land and, to a lesser degree, in the cost of supervision. Land costs have been as low as \$2 or \$3 per acre; planting costs have been considerably less than shown and can be reduced by the use of more planting machines. The cost of supervision is based on the salary of a resident caretaker on 1,000 acres, although this could be reduced further if the area under supervision were 2,000 or 3,000 acres.

Costs of Red Pine - 60-Year Rotation

Trees Planted 8 x 8 or 680 Trees per Acre  
3% Compound Interest

Item	Amount \$	Total in 60 Years \$
Land	10.00 per acre	58.91
Planting, including trees	20.00 per acre	117.82
Management	2.00 per acre per year	326.10
Taxes	10.00 per acre (land only)	65.00
Total for one acre		567.83

\*Report of the Select Committee on Conservation, 1950, p. 140.



Returns from One Acre of Red Pine

60-Year Rotation

Trees Planted 8 x 8, or 680 Trees

(All figures based on stumpage values)

1. Thinnings of 200 trees at 30 years of age  
3,000 bd. ft. at \$20.00.....\$ 60.00  
10 cords pulpwood at \$3.00..... 30.00  

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\$ 90.00
2. Thinnings of 150 trees between 40 and 55 years of age  
5,000 bd. ft. at \$20.00.....\$100.00  
15 cords pulpwood at \$3.00..... 45.00  

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\$145.00
3. Allowing for losses from the 680 trees planted, it is estimated that there should be at least 200 dominant trees left for the final crop.  
  
200 - 15-inch trees for saw timber,  
30,000 bd. ft. at \$20.00.....\$ 600.00  

or
4. 200 - 15-inch trees as poles, at present Crown stumpage rates.....\$ 700.00
5. Previous returns from thinnings could be put back into the operation, or kept separate as a credit at the end of the rotation.  
  
(1. above) \$90.00 for 30 years at 3%....\$ 218.00  
(2. above) \$145.00 for 10 years at 3%.... 194.87  

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Total per acre.....\$1,012.87  
  
If poles harvested (4. above) add \$100...\$1,112.87  
Deduct cost of establishment per acre.... 567.83  

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Net profit per acre \$ 445.04



### 3. Municipal Forests

In addition to the large blocks of land recommended for inclusion in the Napanee Forest are many areas, totalling several hundred acres, on privately owned property. These are areas which cannot profitably be used for agriculture, and where they occupy whole farms or are important from the standpoint of the public good, such as the protection of headwaters of streams, they should be the concern of the county or township councils.

Assistance with regard to the establishment of municipal forests and the supplying of free trees is still the policy of the Department of Lands and Forests. Moreover, as provided by The Trees Act, it is possible for a township council to enter into an agreement with private landowners for the reforestation of their property.

The amendment permits the council of a township to enter into agreements with the owners of land providing for the reforestation of portions of such lands. The agreements will prescribe the cutting conditions of all trees planted and such conditions will be subject to the approval of the Minister of Lands and Forests.

"Provision is also made for exempting such lands from taxation and for making arrangements with the Dominion and Provincial Ministers of Labour regarding conditions of labour and payment of wages in connection with planting and conservation of such areas."-The Trees Act, R.S.O. 1950, c. 399.

The Township of Camden East is the only township which has established a municipal forest. This township has made a small beginning by reforesting 13 acres in two blocks west of Yarker. The first trees were planted in 1939, and survival over most of the larger block of ten acres has been good. The plantation on the smaller block, however, has been almost completely smothered by weeds, fences



have fallen into disrepair, considerable damage has been done by cattle and no provision has been made for fire protection.

Before leaving the subject of municipally-owned forests and forests which provide the local communities with at least a part of their livelihood, it would be as well to review what is being done along these lines in other places.

In Nova Scotia there is a community living on Hammonds Plains near Halifax which depends entirely on wood taken from small woodlands for its livelihood. In this settlement the largest woodlot is not over 400 acres in extent and because of the rocky nature of the soil, the people are not able to augment their incomes by farming, though most families own a cow, a pig and some chickens. The wood from the woodlots is manufactured into barrels and boxes by more than twenty small mills which are largely family-owned and -operated. The people are thrifty and industrious; they have comfortable homes, are public-spirited and extremely forest fire-conscious. This is a community which has developed naturally and yet resembles communities based on a forest economy which have been planned and established in Europe for a considerable time.

One of the most recent is the Forest of Ae in Dumfriesshire, Scotland. It was established by the British Forestry Commission in 1927 and covers an area of 10,683 acres, of which 3,000 acres have been planted, 4,500 acres are scheduled for planting in the near future, 250 acres of the best land have been set aside for cultivation and the balance of 2,800 acres are unplantable because of the altitude but are used for sheep pasture in summer.

The forest is in charge of a forester who resides on the spot, and under him there are foremen and gangs of workers. In the first year sixteen men were employed, just before the war twenty-seven full-time employees were engaged, and by 1960 about ninety men will be needed the year round for



essential forest work. This does not take into account temporary employees who will be required for sawmilling, transport and other jobs. It is planned to create a forest village for the workers embodying a church, a school, playgrounds and sportsfields. The combination of the forest and the village dependent on it is something new in Scotland and represents an important stage in the resettling of men and women in the country. The village is to be the forerunner of other similar villages, and in many parts existing villages will be revitalized by the stimulus of forest wealth.

#### 4. Demonstration Plantations

No demonstration plantations have been set out within the watershed, though the value of these in showing landowners what can be accomplished in a very few years by planting trees is so great that every township should endeavour to establish at least one plot.

In other watersheds these were established under the policy which was laid down by the Government in 1922 when it offered to assist municipalities in the establishment of small forest plantations for the purpose of demonstrating the use of trees on marginal and submarginal land. The requirements are that it be on a well-travelled road and that the land be owned by the municipality; in return the Government will supply the trees free. It is recommended that all the townships within the watershed establish plantations of this nature to serve as demonstrations in each community.

#### 5. Demonstration Woodlots

Demonstration woodlots are privately owned areas of woodland on which the owners have agreed to follow prescribed methods of woodlot management outlined by the Department of Lands and Forests, under the Zone Forester, and to permit access to the area by interested persons. There are no demonstration woodlots on the Napanee Watershed.



6. Tree Farms

In the past few years a movement has been under way to recognize well-managed forest properties as Certified Tree Farms. With the sponsorship of several organizations interested in better forestry, the Canadian Forestry Association in 1953 formed a National Tree Farm Committee to recognize with a suitable sign and certificate those owners who agree to maintain their land for growing forest crops, protect the land adequately, agree that cutting practices will be satisfactory to ensure future forest crops, and permit inspection by Committee foresters.

Several Conservation Authorities have become co-sponsors of the Tree Farm movement in their areas, and it is recommended that the Napanee Valley Conservation Authority give its support to this movement.

7. 4-H Forestry Clubs

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests and must be sponsored by an organization interested in the improvement of woodland and reforestation.

Members must be between 12 and 21 years of age and each member undertakes a project such as marking a half-acre plot of woodland for thinning or reforesting a quarter-acre of land. Projects are judged annually on Achievement Day and prizes awarded; for this purpose the Department of Agriculture furnishes \$3 per member, and the sponsoring organization, \$1.50. Winners may enter the Provincial Inter-Forestry Club Competition.

To date none of these clubs have been formed in the Napanee Watershed.



## CHAPTER 5

### FOREST CONSERVATION MEASURES REQUIRED

#### 1. Reforestation Land

The most important conservation measure required on the Napanee Watershed is the restoration of forest cover on the greater part of the Rock Knob Uplands which cover the northern part of the watershed. This is a rocky area of country covered with sandy till of varying depth. Some of it has been cleared for agriculture and is suitable for the production of crops, but the greater part of it is suitable only for the growing of trees. Repeated fires have swept over it, cattle range over most of it devouring the few seedlings which do establish themselves, and most of the area is so prevented from becoming productive. The establishment of an efficient fire protective system as recommended elsewhere in this report would do much to rehabilitate the region, but reforestation of much of it is also required.

Part of the area, particularly the rockier sites, is still owned by the Crown, as shown on the following table, and it is recommended that the Authority approach the Provincial Government with the object of acquiring this land and placing it under agreement for management.

Kennebec Township	2,300 acres
Sheffield Township	4,700 acres
Hinchinbrooke Township	5,600 acres
Bedford Township	600 acres
<hr/>	
	13,200 acres

#### CROWN LOTS

Township	Concession	Lots
1. Kennebec	VI	1, 2, E $\frac{1}{2}$ 3
	VII	1, 2, 3, 4
	VIII	1, 2, 3, 4, 5
	IX	1, 2, 3, 4, 5



Township	Concession	Lots
2. Sheffield	X	$W\frac{1}{2}$ 4 & 5, $E\frac{1}{2}$ 7, $E\frac{1}{2}$ & $SW\frac{1}{4}$ 8
	XI	4, $W\frac{1}{2}$ 9
	XII	$E\frac{1}{2}$ 7, 12, 13, 14, 15
	XIII	$N\frac{1}{2}$ 1, $E\frac{1}{2}$ 's 6, 7, 8, all 14, $S\frac{1}{2}$ 15, all 16, 17
	XIV	$W\frac{1}{2}$ 15, all 17
	XV	$N\frac{1}{2}$ 3, $S\frac{1}{2}$ 4, $E\frac{1}{2}$ 15, all 16 & 17
	XVI	7, 9, 11, 12, 15
3. Hinchinbrooke	II	17
	IV	16, 17
	V	$W\frac{1}{2}$ 6, $S\frac{1}{2}$ 8, all 7, 9, 15
	VI	12
	VII	$E\frac{1}{2}$ 7, 11
	VIII	$W\frac{1}{2}$ 3, $W\frac{1}{2}$ 8, all of 10
	IX	3, 15
	X	$S\frac{1}{2}$ 1, 11
	XI	8, 10, 11, 12, 13
	XII	11, 12, $E\frac{1}{2}$ 13
	XIII	15
	XIV	16, $E\frac{1}{2}$ 18, 23
	XV	23
4. Bedford	V	10, 11, 12

The remainder is in private hands and a progressive policy of reforestation should be inaugurated whereby lands would be acquired by the Authority as they become available either through tax sales or are put on the market at a reasonable figure.



In the southern part of the watershed there are a number of areas where the restoration of forest cover is necessary to a co-ordinated conservation program for the watershed.





# AUTHORITY FOREST

LEGEND

-  NAPANEE AUTHORITY FOREST
-  RECOMMENDED AUTHORITY FOREST

SCALE - MILES





These are shown on the accompanying forestry maps and have been named after places near them as follows:

LAND RECOMMENDED FOR REFORESTATION

Name	Township	Con.	Lots	Acres
1. Carmanville	Camden E.	IX	N $\frac{1}{2}$ 39 to 45 N $\frac{1}{2}$ 51 to 53	2,000
		VIII	N $\frac{1}{2}$ 43 & 44 S $\frac{1}{2}$ 49 & 50 51, 52, 53	
2. Centreville		V	S $\frac{1}{2}$ 25 & 26	600
		IV	N $\frac{1}{2}$ 23 & 24, 25	
3. Newburgh		III	S $\frac{1}{2}$ 12 to 14	2,550
		II	S $\frac{1}{2}$ 1, S $\frac{1}{2}$ 15, N $\frac{1}{2}$ 19 to 24, 25 N $\frac{1}{2}$ 26 to 34	
		I	S $\frac{1}{2}$ 15 to 17, S $\frac{1}{2}$ 19 to 23	
4. Yarker		II	S $\frac{1}{4}$ 36, S $\frac{1}{2}$ 37 & 58, S $\frac{3}{4}$ 39 N $\frac{1}{4}$ 45 & 46, S $\frac{1}{4}$ 46 & 47	
		I	N $\frac{1}{2}$ 33 to 40, N $\frac{1}{2}$ 45 to 48	1,800
5. Bellrock		Portland	XI	14, 15, 17, 18
Total				7,750

LAND CLASSIFICATION

Name	Woodland	Marsh	Scrub	Open	Total
1. Carmanville	262	76	21	1,641	2,000
2. Centreville	117	-	2	481	600
3. Newburgh	400	4	44	2,102	2,550
4. Yarker	156	-	10	1,634	1,800
5. Bellrock	85	-	-	715	800
Totals	1,020	80	77	6,573	7,750



(1) Carmanville

The Carmanville tract actually lies on the Shield, but because it borders on the agricultural land and completes the land recommended for reforestation in Camden East Township it has been included here. It embraces four separate areas as shown on the map, but conditions are similar throughout with shallow soil and rock outcrops. There are 2,000 acres in all, with 262 acres of woodland, 76 acres of marsh and 21 acres of willow scrub. The open land containing 1,641 acres is largely badly run-down pasture.

(2) Centreville

This is a small area south of the village of Centreville. The soil over the limestone rock is very shallow; the land is used for pasture but is almost non-productive. trees would be the best crop which could be raised here and would gradually build up a layer of duff or humus which would help to retain moisture and reduce its loss through the rock below. It embraces 600 acres - 117 acres of woodland, 2 acres of scrub and 481 acres of open land. The woodland is nearly all swamp, most of it part of the hardwood swamp at the west end of Mud Lake.

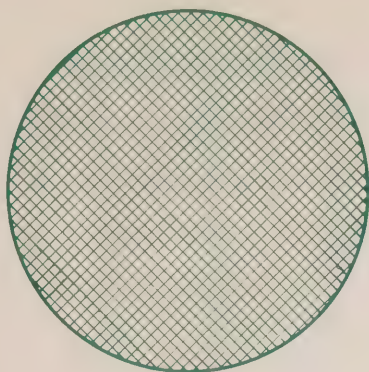
(3) Newburgh

Newburgh includes six areas surrounding the village of the same name; all are on the limestone plain and have similar soil conditions. Rock outcrops are numerous. There is considerable bush, most of which occurs in swamps through which tributary streams flow to join the Napanee. The total area included here is 2,550 acres, with 400 acres of woodland, 4 acres of marsh, 44 acres of scrub and 2,100 acres of open land.

(4) Yarker

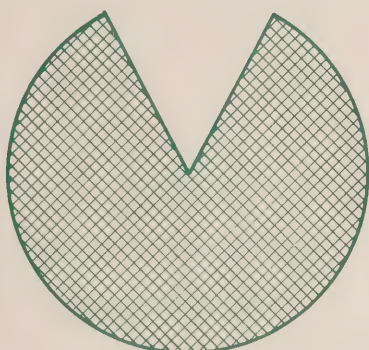
This is also on the limestone plain with shallow soil over limestone rock and includes two areas, one of 1,200 acres to the west of the village and the other of 600 acres to





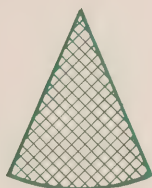
REFORESTATION LAND  
(SOUTHERN PORTION)  
TOTAL AREA

7,750 Acres  
(100%)



OPEN LAND

6,573 Acres  
(84.8%)



WOODLAND

1,020 Acres  
(13.2%)



MARSH

80 Acres  
(1.0%)



WILLOW

77 Acres  
(1.0%)



the east. West of the village the land is hilly, sloping down to the Napanee River, and considerable erosion has taken place here. There are 156 acres of bush, 10 acres of scrub and 1,634 acres of open land.

(5) Bellrock

Bellrock, like Carmanville, is actually in the Rock Knob section but since it embraces two isolated areas in Portland Township it has been included here. These comprise 400 acres each or 800 acres in all, with 85 acres of bush and 715 acres of open land which is largely rock and low-grade pasture.

Restoration of the forest cover to the land in all these areas would not only serve to protect them, slowing down run-off from the rocks and holding water in the natural water-storage areas of the swamps, but would greatly improve the economy of the whole region by growing timber on land which is otherwise unproductive and thus providing work for the local people.

The present cover of these areas is indicated on the map as woodland, open land and scrub land. Woodland in most cases will require little work in the near future except that of erecting fences to exclude cattle. Open land should be planted with trees of suitable species as soon as possible, and planting should be carefully planned beforehand. Many of the rocky areas, both on the limestone and the igneous rocks, have had all the original soil washed off them into cracks and depressions. Here planting would consist of setting out perhaps 200 trees to the acre of dry-sited species, wherever it is possible to get them in. This would be a start, and with fire protection the slow process of restoring a layer of forest duff would be under way, though it might take a century or more to rebuild the ground cover to its original depth.



*White pine, white spruce and balsam grow well even on the shallow soils of the limestone plain.*



*In spite of the shallow soil white cedar, white pine and common juniper will grow and maintain cover if they are protected from fire and cattle.*

*Sugar maple, basswood and rock elm will put their roots down into the crevices in the rock and produce worthwhile timber on soils too shallow for other crops*





## 2. Willow Scrub Areas

In addition to the rocky land there are about 3,000 acres of scrub land. This is mostly poorly drained land covered with scrub willow and alder, though in the south end there are some fairly large patches of prickly ash (Zanthoxylum americanum), sumach and hawthorn. The willow scrub areas present a problem in planting and research should be undertaken to determine the best method of handling them. There appears to be a natural succession from neglected pasture land through willow scrub, trembling aspen, white elm and black ash to the climax types of silver maple - white elm or black ash - white elm - red maple and every effort should be made to determine the best method of speeding up this succession.

In addition to the large areas of limestone, moraines, igneous rock, sandy land and shallow soils, there are innumerable smaller areas forming parts of farms which will always be in private hands. The aggregate effect of this on stream flow is very considerable. These should be planted with trees to form part of the farm woodlots where they occur. Many of them should be placed under a reforestation and controlled woodlot scheme by the Authority, especially where they cover the sources of streams. Under this scheme the owner would get considerable help from the Authority in the establishment and maintenance of the woods, but would not be permitted to cut them indiscriminately. (See Controlled Woodlot Management.)

## 3. Controlled Woodlot Management

Before the necessary conservation measures on that part of the watershed, exclusive of the proposed watershed forest, can be properly co-ordinated, some system of controlled cutting of privately owned woodlots must be established. The reason for this is that the average owner does not take a broad view of the value of forest cover and is not interested, to any



great extent, in what may happen to land or stream flow off his property. The result is that throughout the watershed there is a systematic cutting of woodlots, both for the purposes of lumber and firewood. This type of cutting has been in progress for many years, and the portable sawmill has done a great deal of damage in removing, particularly, young, thrifty trees. The system of selling acre or half-acre blocks of timber for fuel-wood is also another vicious practice, for the reason that, when a purchaser buys such a block, in nearly every case he clean-cuts every tree which can be used, down to an inch or two in diameter. Some system of regulating cutting would correct this situation, and certainly the areas which are connected in any way with the headwaters of streams, or the feeding of springs, should be controlled to the extent that they cannot be clean-cut.

Where conditions warrant, a certain amount of cutting would be continued, but should be controlled by agreement with the Authority. Only such trees should be cut as are marked by a competent person. Provision should be made for restocking where necessary, the intention being to interfere as little as possible with the economy of farm property where the supply of wood is concerned. County by-laws restricting cutting, passed under the Trees Act, do not prevent an owner from clear-cutting any area if the wood is for his own use.

The question of clean-cutting of woodlots on this area, and for that matter, throughout all of Southern Ontario, is of serious import, and is one of the chief reasons why some system of control should be instituted. For many years now conservationists have advocated controlled cutting of woodlots. In some sections, particularly in tobacco-growing counties such as Norfolk County, the destruction of woodlots for the curing of tobacco has become alarming. It is admitted that the question requires delicate handling, but where the good of the whole community is envisaged some middle



road of agreement could be arrived at. Furthermore, the distribution of free trees by the Government for conservation purposes is sometimes criticized, and rightly so, where on one farm the owner plants an area with seedlings and in the same year his neighbour clean-cuts a woodlot which perhaps protects the headwaters of a stream.

It is admitted, of course, that there are extenuating circumstances when a farmer may consider it necessary to raise money by selling timber. This, in itself, is not so serious if the cutting is done in such a way that the benefits of the forest are retained. Young forests, as well as old, protect the soil and have water-regulating value, but the clean-cutting of such areas is a destructive and vicious practice which should be stopped.

The basis on which a regulation of this kind should be carried out is a consideration of the woodlot concerned. To make a blanket ruling that all woodlots on the Napanee should not be cut, or should come under one type of control measure, would not work to the best advantage of the community, and certainly would not be in the interests of good forestry.

Some woodlots have reached the stage in which they are worn out and if the land is good should be cleared off and cropped. Others may be composed of a high percentage of worthless species and have no relation to water regulation in the countryside and likewise could be disposed of to advantage. But where the woodland has a direct bearing on water regulation, erosion, retarding of the wind, and similar benefits, the desire of the individual should be sacrificed for the good of the community. The whole question, therefore, resolves itself into an examination of each woodlot by a competent person, and the prescribing of a program of management to suit each case.



4. Fencing Woodlots from Cattle

A worthwhile attempt at forestry action in Southern Ontario was the step taken by the County of Halton in 1948, when the County Council passed a by-law to aid farmers in fencing their woodlots from livestock.

The by-law as revised in 1949 states that the County of Halton will grant a sum equal to the cost of the fence wire to a woodlot owner who will erect such a fence on one or more sides of his woodlot in order to completely enclose the woodlot, thus fostering forest growth by keeping livestock out. The woodlot must be of a size not less than two acres and livestock must be excluded for a minimum period of twenty years.

Such action by the County Council is commendable, although this program has not as yet had a very marked success. It is recommended that the Napanee Valley Conservation Authority, through discussions with woodlot owners, should formulate some modification of this program which will stimulate action toward the elimination of woodland grazing and the improvement of private woodlands.

5. Diameter Limits (The Trees Act)

The basic method of control of cutting usually advocated is cutting to a diameter limit, that is, that all trees below a certain diameter (for example fourteen inches) should not be cut. Such a regulation may or may not be good forestry. In most cases it would not be, because there would be much worthless material below this diameter limit, such as poplar, thorn, willow and other species, which should be taken out. At the same time, there would be certain large trees above the diameter limit which should be left for the benefit of the forest, as well as trees suitable for re-seeding the area. The diameter limit should not be a fixed rule, but simply a guiding principle; a sort of yardstick, on which the landowner can base his calculations.



COUNTY BY-LAWS RESTRICTING THE CUTTING OF TREES  
UNDER THE TREES ACT

As of January, 1957

County	Date Passed	Diameter Limit (inches)	
		Cedar & Certain Species	Most Species
BRANT	Nov. 2/48	5	14 Stump 18"
BRUCE	June 13/53	8	12-14 Stump 18"
DUFFERIN <sup>1</sup>	Jan. 20/56	8	12 Stump 18"
DURHAM & NORTHUMBERLAND	Apr. 8/53	5	10 D.B.H.
ELGIN	Nov. 25/48	5	14 Stump 16"
GREY <sup>2</sup>	Nov. 13/53	8	12-14 Stump 18"
HALDIMAND <sup>2</sup>	May 13/49	6	14 Stump 18"
HALTON	Apr. 15/47	7	14 Stump 18"
HASTINGS <sup>4</sup>	Jan. /57	0	10-13 Stump 24"
HURON	June 16/50	5	14 D.B.H.
LAMBTON	Jan. 21/50	7	14 Stump 24"
LEEDS/GRENVILLE	June 13/53	0	14-16 Stump 18"
LINCOLN	Jan. 21/53	6	14 Stump 18"
MIDDLESEX	Mar. 12/47	6	14 Stump 18"
NORFOLK	Nov. 8/55	6	14 Stump 18"
OXFORD	Jan. 27/48	5	12 D.B.H.
PEEL	May 15/49	6	12 Stump 18"
PERTH	Jan. 21/56	8	16 Stump 18"
WATERLOO	Apr. 22/49	7	14-16 Stump 18"
WELLAND <sup>3</sup>	Oct. 17/56	6	14 Stump 18"
WELLINGTON	Apr. 24/48	6	14 Stump 18"
WENTWORTH	May 12/49	6	14 Stump 18"
YORK <sup>4</sup>	Nov. 18/49	0	14 Stump 18"

D.B.H. is diameter breast high or 4½ feet above ground

1. Dufferin has a 10-inch limit on basswood.
2. Haldimand also has 8, 10, or 12-inch limits on a few species.
3. Welland has a 12-inch limit on spruce, tamarack and aspen.
4. Subject to approval by Minister of Lands and Forests.



Twenty-three counties have passed by-laws under The Trees Act (R.S.O.1950, c.399) which empowers the council of county to pass by-laws restricting and regulating the cutting of trees. In each case the by-law has fixed minimum diameter limits below which trees may not be cut except in special circumstances. The object of this is to prevent the cutting of trees at the time when they are putting on their greatest diameter growth. These limits are usually 5 to 8 inches for white cedar, red cedar and black locust, and range from 10 inches to 16 inches in the various counties for all other species. The limits which have been set are actually far too low for good forestry practice as most trees are making their maximum diameter growth after they reach 18 inches in diameter, but it is an elementary step in the right direction. Every county should have restrictions of this type and it is recommended that similar powers be extended to Conservation Authorities as a means of protecting existing woodland on their watersheds.

#### 6. Forest Fire Protection in Southern Ontario

The task of protecting woodlands from fire in Southern Ontario presents a very different problem, or rather series of problems, from those of Northern Ontario, and consequently must be handled in a somewhat different manner.

Northern Ontario is predominantly forest land, the population is sparse, parties travelling through the forested areas are fairly readily accounted for by means of a permit system during the fire season, and watch is maintained for fire by means of look-out towers and air patrol.

In Southern Ontario south of the Laurentian Shield the land is normally potential agricultural land with the woodland surviving in isolated patches as farm woodlots or in larger more or less continuous blocks of swamp or sand up to ten thousand acres in extent. The population is, relatively speaking, fairly dense, no part of any woodland is more than



two miles from the nearest human habitation and most roads are travelled by a comparatively large number of people.

In spite of the publicity given to the damage caused by fire the average person does not realize how serious this is. Though he may know that young growth and small trees are burned by surface fires, he does not realize the extent of the less obvious damage such as the destruction of humus which itself preserves the condition and water-retaining capacity of the soil. When the humus and ground cover are destroyed the sun and dry winds remove the moisture required for tree growth and plant nutrients are destroyed. The heat of the fire also injures the growing tissue inside the bark of older trees which are not actually burned, exposing the wood to attack by insects and fungi. Even though through time the wounds may be completely healed, the damage shows up as defects when the tree is cut for lumber.

Many farmers in Southern Ontario are so completely unaware of, or indifferent to, the damaging effects of fire that they deliberately set fire in peat land to burn off the peat, starting fires which it is next to impossible to extinguish. Such fires burn for months, even under the snow, destroying many acres of woodland every year, not only on the land of the person setting the fire but frequently spreading over land adjacent to it.

The first step in fire control is fire prevention, and the best assurance of prevention is an enlightened public opinion which will make every member of the rural community conscious of the seriousness of fire damage and of his duty as a citizen to do all he can to prevent it. The farmer can prevent most fires in farm woodlots if he exercises the same care that he does around his home and buildings.

Experience in the United States has shown that the most effective fire protective systems in rural districts are those set up under a state organization with local wardens



appointed by the state forester on the recommendation of the local town\* councils. In the rural parts of the State of Maine each town appoints its own fire wardens who handle fire protection in the town quite independently of other towns. This means there is a lack of co-operation between towns, wardens receive little practical training, organization is loose, and as wardens hold office at the pleasure of the town council there is a serious lack of continuity in administration.

In New Hampshire and Vermont wardens are appointed by the state forester on the recommendation of the council and in Vermont they serve until they resign or are removed for cause by the state forester.

Mr. H. H. Chapman, writing in the Journal of Forestry, states<sup>†</sup>: "It is not unreasonable to conclude that the ratio of 34 to 1 in damage per acre of woodland between these two states (Maine and New Hampshire) is the direct consequence of Maine's failure to depart from the 'fire bucket' principle of town organization".

From the evidence collected in the northern states of the United States, where conditions most nearly approximate those of rural Southern Ontario, it is apparent that the most effective fire protective systems are those set up under the following conditions:

- (a) Where the system is organized under the direction and control of the state forester and the wardens in each town are appointed by him on the recommendation of the local council.
- (b) Where wardens paid an annual retainer are actual residents in the locality. Usually

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\* The "town" in the Eastern United States corresponds closely to the township in Canada.

† Journal of Forestry, Vol. 47, No. 2, 1949.



they are farmers who have had practical instruction in fighting fire. They have the power to call out other local residents to help in firefighting and maintain a store of firefighting tools on their premises.

- (c) Where the warden is assisted in his work by all members of the community. That is, his address and telephone number are known to everyone and fires are reported to him immediately.
- (d) Where designated members of the community know that they are likely to be called on to fight fire and are paid so much per hour for the time they are so employed.
- (e) Where every resident is thoroughly fire-conscious and realizes that loss of timber by fire is a loss to the whole community, and considers it his duty to prevent, report and fight fire.
- (f) Where fires for burning brush and rubbish may be set only after a permit has been obtained from the local firewarden.



## CHAPTER 6

### FOREST INSECTS AND DISEASES

#### 1. Forest Insects

In any project, such as that proposed for the Napanee Watershed, careful consideration should be given to the prevention of insect outbreaks and adequate arrangements made for the immediate application of control measures when these become necessary. While it is not possible to predict accurately the course insects may take under the ever-changing conditions of a newly forested area, there are a number of fundamental principles which, if applied, will greatly lessen their destructiveness.

It is important to avoid the planting of large areas of one kind of tree, otherwise conditions will be ideal for an outbreak of abnormal numbers of some insects which prefer the food afforded by that particular host. It is preferable to plant in blocks, the blocks distributed so that trees of one species are separated by blocks of different tree species. This tends to keep outbreaks localized until natural agencies bring them under control and facilitates direct control measures if such become necessary.

It is important to plant only the species of trees suitable to the site and existing growing conditions. Healthy, vigorous trees are certainly more resistant to insect attack than weak, struggling ones.

Over-mature and dead trees should be removed from the existing stands as these harbour bark-beetles and wood-boring insects, which may become excessively abundant and attack healthy adjacent trees.

Care should be exercised to prevent ground fires. Even light ground fires are frequently followed by severe outbreaks of bark beetles and wood-boring insects.



Woodcutting operations, sawmill sites and wood storage yards should be carefully supervised or they may become reservoirs of infestations.

It is essential that surveys for insect conditions be made each year so that any abnormal increase in insect populations may be noted and control operations initiated before they develop to outbreak proportions. Serious and widespread outbreaks are frequently prevented by prompt and well-timed spraying operations over a comparatively small area. It is therefore necessary that spraying equipment be available and that laneways be maintained within the plantations for spraying purposes. Outbreaks of an extensive nature can generally be brought under effective control by strip spraying. In this method, alternate strips of trees in large plantations are sprayed, thus reducing the initial infestation and at the same time causing the native parasites to concentrate and build up in the unsprayed portions. This reduces spraying operations and the number of lanes for the passage of spraying equipment.

Owing to the danger of injury by the white pine weevil, white pine should not be planted in pure stands unless the stands are very densely stocked in a good site. It is better to grow white pine in mixture with some immune species, such as the better hardwoods. The protecting species should be taller than the white pine, at least in the early years.

In conclusion, it should be recognized that protection against leaf-feeding insects is very desirable since defoliation of a tree weakens it and thus makes it more susceptible to attack by bark-beetles and wood-boring insects as well as by organisms which do not usually attack healthy trees but which will hasten the death of weakened trees. Leaf-feeding insects alone may kill a thrifty, broad-leaved deciduous tree by completely defoliating it for three years in succession. Conifers, however, are usually killed as a result of one complete defoliation.



## 2. Tree Diseases

Productive woodlands require protection against fire, trespass, grazing animals and rodents, insects and disease. Protection is a part of forest management, and under a policy of sustained yield will be maintained in continuity. Good forest management is reflected in the health of the woods and, conversely, damage on account of disease is often a sign of mismanagement or neglect. In general, an objective of maximum yield, with attendant intensive silviculture, is compatible with and often facilitates protection and disease control.

For the purpose of discussing their pathology and protection, the hardwoods may be considered separately from pine in natural stands or plantations. The chief diseases of the hardwoods are the various trunk, butt and root rots and chronic stem cankers, which are all endemic and may cause serious damage under aggravating conditions. Woodlots on the Napanee Watershed present very diverse conditions with respect to the incidence of these diseases, a circumstance which is usually related to their past history. Thus many containing old timber are in need of heavy preliminary salvage and sanitation cuttings, as a result of mismanagement or neglect. Such cuttings should precede or be combined with cleanings and improvement cuttings designed to improve the composition and structure of the stands. Having established a sanitary condition, normal care should maintain it and obviate loss on account of decay.

The wood rots are commonly thought of as diseases of mature and over-mature timber, but experience has shown that infection may occur at a very early age. Thus in hardwood sprouts the stem may be infected from the parent stump. In older trees infection is chiefly through wounds, either of the root or trunks, which may be caused by fire, trampling by animals, insects, meteorological agencies, or by carelessness or accident in felling and other woods operations.



Hardwoods are commonly cut selectively and not infrequently in clear fellings. Few foresters will approve the latter system, which is in fact often intended as a liquidation of the property. A system based on yearly selection, or frequent periodic return to conveniently planned subdivisions, has obvious advantages for small woods and is well adapted to the control of decay.

For many reasons "cleanings" in the reproduction are desirable, especially where the woods have been heavily cut. While favouring the valuable species, those sprouts which, on account of decay hazard, are of undesirable origin should be eliminated. Such will comprise sprouts from the larger stumps and those from above-ground position.

In harvest cuttings, which should recur at frequent intervals, the permissible volume allotted should include trees in which incipient decay is discovered and, so far as possible, those which have become a poor risk through injury or other circumstance.

White pine is found in young plantations and in natural stands, almost pure, or mixed with hardwoods. From the latter stands it tends to disappear, on account of hardwood competition, except on sites which are particularly favourable for its reproduction. The white pine blister rust, with the well known shoot weevil, is a principal enemy of the species and is a factor contributing towards the elimination of seedlings and young trees.

White pine should be encouraged on those sites which are naturally suited to its reproduction, so that fairly compact growth may be secured, thereby facilitating the protection problem. It is an important and valuable species in Southern Ontario, and its cultivation should be promoted by the institution of effective blister rust control facilities.



## CHAPTER 7

### LAND ACQUISITION

The problem of land acquisition in any part of agricultural Ontario, where practically all the land is privately owned, is one which requires careful approach. The ownership and use of land, especially for agricultural purposes, is considered by most citizens as one of their few remaining inalienable rights. However, where the good of the whole community is under consideration, such personal rights should be, and have been, overruled under the principle of eminent domain. Examples of such cases are the building of highways, the construction of power lines, and the acquiring of land for military purposes in the event of a national emergency.

In Southern Ontario compulsion has not been exercised to any great extent by the Government in planning proper land use schemes. But who would gainsay the fact that the acquiring of poor land on the Napanee Watershed for conservation purposes constitutes a national emergency, and therefore requires a more permanent authority than the individual to bring it back to its proper use?

However, in dealing with land acquisition, it should not be the desire of any authority to approach the problem in a dictatorial manner. It will require careful handling, and as a preliminary step in such work the people of the area should be acquainted with the purpose of the scheme, its ultimate benefits to the community, and by explanation and demonstration be gradually brought to the point where they will be glad to co-operate.

The only part of the Napanee where large-scale transfers of property from private ownership to a forest authority would have to be made are those areas which are recommended as reforestation land on the Limestone Plain and a large part of the Rock Knob area in the northern part of the watershed.



It is true, of course, that there are fewer farms in the area which are as good as many in other parts of the watershed, but in any large area of poor land on which some agriculture is being practised this might be the case. However, it is not essential that the best farms be withdrawn entirely from agriculture, but an arrangement could be arrived at so that such farms, where the upkeep of public utilities is not too heavy, could be retained as agricultural land. Such areas could be incorporated into the forest as farm land and be used by forest workers for this purpose, one supplementing the other at different seasons of the year.

1. Methods of Acquiring Land

There are several ways in which land can be acquired and controlled for conservation purposes, and it is proposed to enumerate and discuss these briefly in this section.

(a) Crown Land

The Counties of Peterborough and Victoria have both established extensive county forests through the purchase of Crown land within their borders from the Provincial Government, and the Grand River Conservation Commission has also secured Crown land from the Government for a nominal sum. Victoria County has placed its forest under the County Forest agreement with the Department of Lands and Forests but Peterborough County is managing its forest independently. The Crown land in the northern part of the Napanee Watershed might be acquired by the Authority in a similar way.

(b) Transfer by Private Sale

The most satisfactory method of acquiring land is by private sale between the Conservation Authority concerned and the landowner. This method has been followed by the counties of Ontario in purchasing land for reforestation work in building up the system of county forests, which totals, in round figures, 65,000 acres. This method has its drawbacks, however, as



individuals who have not the community's welfare at heart, or for one reason or another have an exaggerated idea of the value of their property, may block the completion of a unified area by refusing to sell. This was overcome in the State of New York, where over 450,000 acres of land have been purchased for reforestation, by refusing to buy individual parcels of land unless there was a sufficient number in a group to make a contiguous block of 500 acres.

(c) Maximum Price per Acre

Another method which has been used has been to fix a maximum price per acre for this class of land, beyond which the forest authority is prohibited to go; allowance being made for the presence of good fencing and buildings on the properties, which in some cases have been removed by the vendors and allowed as part payment for the land.

(d) Agreements

Where owners of property prefer to retain their woodlots, or where parts of farms fall within the forest area prescribed, and providing the retaining of ownership does not jeopardize the complete conservation scheme, agreements could be made for the control and management of such areas.

This method has been adopted by the Dominion Forest Service in Nova Scotia, where it has been desirable to control wooded areas for experimental and conservation schemes, and in this particular case the agreements cover a period of twenty years.

In Ontario there is one example, at least, where a municipality leased a part of a farm for reforestation work for fifty years, and one United Counties' council has adopted the plan of taking easements on land for the same purpose.

(e) Control by Existing Legislation

Under the authority of the Private Forest Reserves Act (R.S.O. 1950, c.288), the Minister of Lands and



Forests, on recommendation to the Lieutenant-Governor in Council, may, with the consent of the owner of any land covered with forest or suitable for reforestation, declare such an area to be a private forest reserve. When such an arrangement is made, the Minister, or his representatives, may reforest such areas, supervise the improving and cutting, and prohibit the removal of trees by the owner without his consent, and also prohibit the grazing of the area by cattle.

(f) Life Lease

Many of the farms on the proposed forest, as already mentioned, are of low agricultural worth and are supporting families at the present time. The problem in such cases is not so much the purchase of the property as what will become of the family after the farm is acquired. In almost every case it would be impossible for the vendor to purchase another farm with the money he receives, except one which is of approximately the same value, outside the forest. In some cases such farms are occupied by older people whose families have grown up and left the community. The removal of these from their properties might work undue hardship on them, and in fact in some cases they might become a burden on the municipality. With some of these, the plan of giving the vendor a life lease would be sufficient. In most cases such old people make little attempt at farming the whole property, but require only sufficient pasture for a cow or two, enough land for a garden, the house and buildings; and a supply of fuel-wood. The plan of giving a life lease has been adopted in the case of two properties,\*at least, on the county forests in Ontario, and has proved satisfactory to both contracting parties.

(g) Tax Delinquent Land

Under the Statutes of the Province of Ontario†

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\* Northumberland Forest and Angus Forest.

† The Assessment Act, R. S. O. 1950, c.24, s.143.



land which becomes tax delinquent is sold by the County Treasurer. In the case of farm land this is not done in practice until the land has been in default for three, or in some cases four, years. Even then the owner has the privilege of redeeming his property within a year. Where such lands are marginal or submarginal, they are sometimes bought for only a part of the area which is of special value, such as woodland, old buildings, or a good field or two. In some instances the poor land remains idle and frequently appears again at the tax sale. The fact that such land becomes tax delinquent is an indication in many cases that its ultimate use is forestry. Under the present Statutes the municipalities are not permitted, at the first sale at least, to acquire or reserve such land for conservation purposes. Consequently this report recommends that the Authority expropriate all tax delinquent land subject to the regulations of the Municipal Act.

(h) Expropriation

As a last resort in land purchases, or where the owners of abandoned land cannot be located, such areas can be acquired by expropriation. The Conservation Authorities Act (R. S. O. 1950, c.62, s.15), states:

"For the purpose of carrying out a scheme an authority shall have the power to purchase or acquire and without the consent of the owner, enter upon, take and expropriate any land which it may require and sell or otherwise deal with such land or other property."

Also under the Forestry Act (R. S. O. 1950, c.147, s.13), provision is made for the removal of settlers from lands unsuitable for farming. To quote:

"Whenever in the opinion of the Minister, it is found that settlement has taken place on lands not suitable for agricultural purposes, and which said lands are required for forestry purposes, the Minister shall have power to make arrangements for the removal of such settlers upon such terms as may be agreed upon."

As a matter of general interest, it should be stated that this Act also provides for the power to close the roads on lands taken over for forestry purposes, the setting



apart of lands for settlement, and the removing of settlers from lands unsuitable for farming. It should also include, however, provision for acquiring permanent or community pastures, and pondage areas where these are required, as an integral part of a large conservation project.

2. Cost of Land in the Proposed Authority Forest

It would be impossible to give an accurate figure for the total purchase price of all land in the proposed forest without consulting the owners of the individual parcels. However, as an indication for arriving at the approximate cost, the amounts paid by the several Conservation Authorities of the Province in purchasing land for their forests will serve as a guide.

TABLE SHOWING COSTS OF LAND PURCHASED FOR FORESTS

Name of Authority Forest	Acres	Cost \$	Cost per Acre \$
Ausable	634	12,700.00	20.03
Ganaraska	3,253	22,078.00	6.78
Humber	411	11,795.00	28.70
Moirs	985	4,605.00	4.68
Thames	1,980	10,870.17	5.49
Total	7,263	62,048.17	8.55

It should be pointed out that land acquired in the future by the Ganaraska Authority is likely to cost more than the average price per acre of \$6.78, because most of the poorest denuded land has now been taken up and the remainder has more woodland and potential woodland which will naturally raise the purchase price. The very low cost of land in the Thames Watershed is explained by the fact that it is mostly burned-over swamp land with a peat soil which is of no economic value at the present time. Actually the average price of \$5.49 per acre includes a ditch tax which exists as a lien against part of the property, so that the price of the land itself was



closer to \$1.00 per acre. On the Thames Watershed, too, most of the poorest land has now been acquired and the cost of the remainder will certainly be higher. The cost of land on the Moira, namely \$4.68 per acre average, is an indication of what the cost of reforestation land for the Napanee Forest would be because the land types are similar.

The development of a comprehensive conservation program is a long-term project and it may be fifty years before the Authority has all the land required. The present policy of acquiring and reforesting some land each year is a sound one, and where the cost of certain areas is too high the Authority can afford to wait, because the land is deteriorating in productiveness through cutting, fire, grazing and neglect and eventually the price must fall too.



## CHAPTER 8

### SNOW FENCES

In the climate of Southern Ontario snow drifting may cause much inconvenience and sometimes hardship. Control can be readily effected by means of windbreaks and is dependent on proper placing with reference to lanes of travel and topographic features.

Where space is limited or land valuable lath or board fences are frequently used, but the cost of erection, removal or maintenance of these can be materially reduced by using trees as permanent windbreaks or shelterbelts. One or two rows of trees are usually referred to as a windbreak and more than two rows as a shelterbelt. The latter is preferable if space permits as it gives better and more permanent protection.

The prevailing winds in Southern Ontario are generally from the west so protection is usually required on the west side of north-south roads, on the north-west side of northeast-southwest roads, on the south-west side of north-west-southeast roads and on the north side of east-west roads.

The object of a snow fence is to mechanically reduce wind velocity near the ground in such a manner as to cause a drift to form where it will be least harmful. The reduction in velocity creates two pools of relatively calm air, a small one on the windward side and a much larger one on the leeward side, and it is here that drifts form, leaving the area further to the leeward free of drifts and comparatively free of snow. The deepest part of the calm pool is close to the windbreak; if the windbreak is open at the bottom - that is, composed of trees with few or no branches near the ground - the deepest part will move further to leeward. As winds become stronger both the depth expressed in terms of velocity reduction and the width of the pool on the leeward side will increase and the centre will tend to



move further away from the windbreak.

A single row of trees, unless it is a dense coniferous type, is seldom dense enough to completely stop winter wind and may create drifts, just as poor placement of windbreaks may accentuate drifting conditions.

A wide belt of trees which will accumulate a large drift of snow on its windward side may be planted right to the edge of the road, the windward edge extending back a distance equal to three or four times the height of the trees and generally at least 100 feet.

In some places the snow trap type of windbreak is effectively used. It is composed of one or more rows of trees close to the road with a wide opening to windward and then a single row of trees. The single row arrests the first force of the wind and the snow is deposited in the opening. This has the advantage of requiring fewer trees than the shelterbelt and leaving the ground between open for cultivation in summer.

Any prejudice which may exist against windbreaks for protection against drifting snow on roads arises from poor or poorly placed windbreaks. If a windbreak has openings in it or if it ends abruptly streamer drifts will form. Windbreaks should be kept dense and tapered down at the ends by using progressively smaller species of trees and shrubs to prevent the formation of streamer drifts.

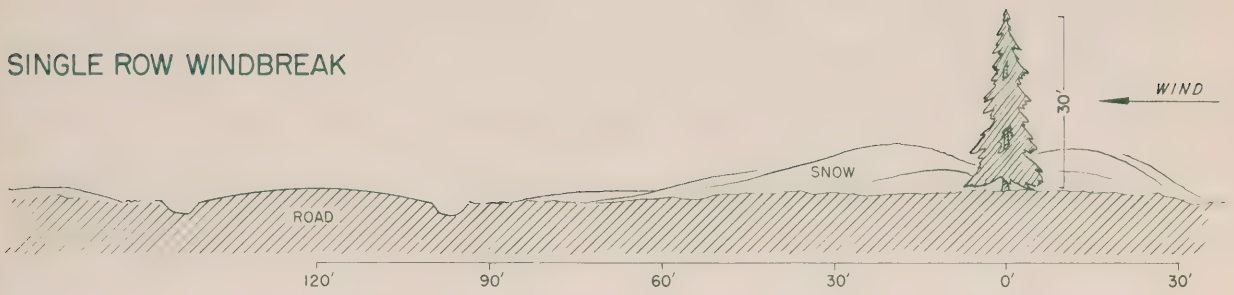
Trees are being used successfully as snow fences in Ontario by the Department of Highways, by railways and by a number of counties.

The practice of the Department is to acquire the land by purchase to a width of 100 feet from the centre line of the pavement and plant a three-row windbreak 80 feet from the centre line. The land is ploughed and cultivated and bushy stock about 2 feet high is used. Weeds are kept mowed between the rows and on the open strip between the

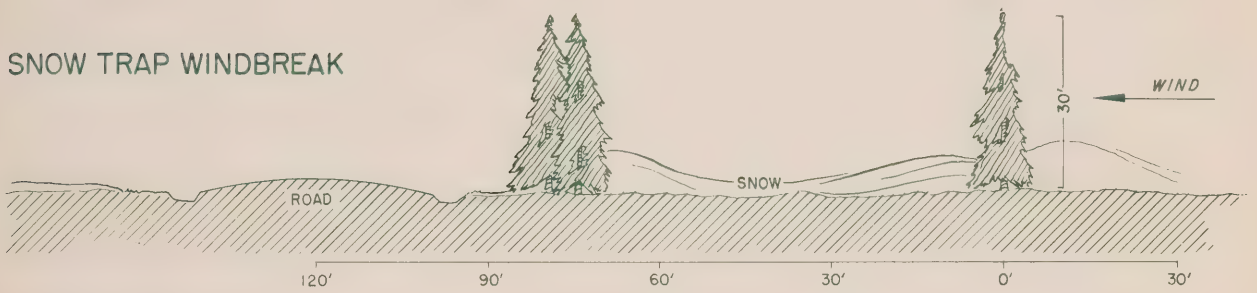


# SNOW FENCES

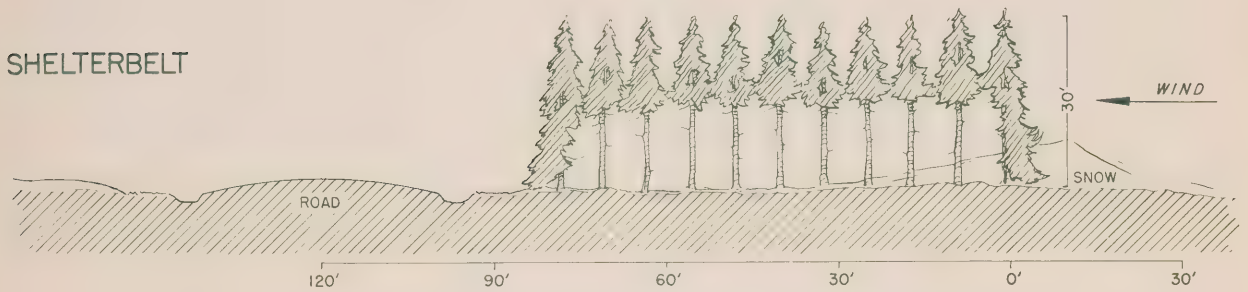
SINGLE ROW WINDBREAK



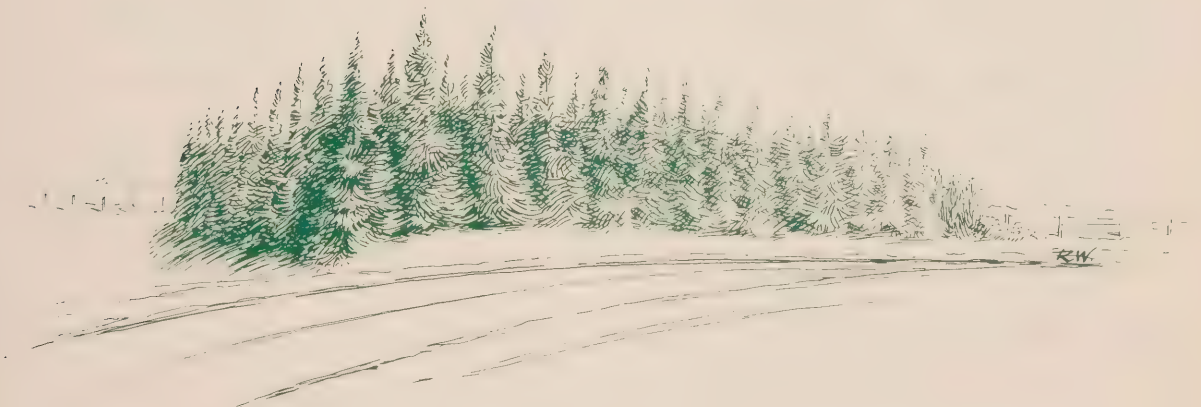
SNOW TRAP WINDBREAK



SHELTERBELT



CROSS SECTIONS OF ROAD AND SNOW FENCES



Two methods of preventing drifts at the ends — left end of shelterbelt terminates at a hollow, right end is tapered down to the ground.



windbreak and the pavement, which entails a lot of work on the part of the maintenance crews in summer. The windbreaks are kept down to a height of 7 feet, partly because many farmers object to their view of the highway being obstructed and also because they are proud of their herds and fields which they want to be visible to passers-by. Also cutting the tops off the trees reduces the temptation, which some persons find irresistible, to cut them for Christmas trees.

County practice varies; sometimes the land is purchased, sometimes it is leased and sometimes it is planted by agreement. In all cases the County erects a fence behind the trees. In return for the use of the land one county plants a three-row windbreak around the farm buildings. Waterloo County has planted an excellent shelterbelt over four miles long on the west side of the county road running north through Linwood. Here the County has acquired a twelve-rod strip (198 feet) and planted the six-rod strip farther from the road, leaving the six-rod strip next to the road to catch the drift while the trees are small. When the trees get bigger it is planned to complete the shelterbelt by planting the six-rod strip next to the road. The trees used are transplant stock about one foot high obtained from the Department of Lands and Forests and planted in furrows. Weeds are kept mowed until the trees are large enough to shade them out.

The species of trees used are Scotch, jack, red and white pine, white and Norway spruce and white and red cedar. The Department of Highways uses both white and red cedar, which it obtains from areas where they are growing naturally, as well as some species usually considered as ornamental stock which it grows in its nurseries. These include mugho pine, barberry and Chinese elm. This last is the only hardwood tree used in windbreaks. It grows rapidly and its fine branching system makes it nearly as effective as an evergreen tree. The other common hardwoods such as Carolina poplar, white elm, silver maple and white ash are used fairly extensively in shelterbelts.



Snow fences are usually beneficial to crops in that they hold moisture in the fields in the form of snow in winter and reduce wind velocities and moisture loss by evaporation in summer. Occasionally they do cause ice to form over crops such as fall wheat and may be harmful in this way. The beneficial effects, however, outweigh the harmful ones so considerably that every encouragement should be given to their establishment in place of the removable type of lath fence currently in use.



## CHAPTER 9

### WINDBREAKS

In the process of clearing land for agriculture woodlots and belts of trees along fence lines have been removed which had served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario. E. I. McLoughry\* in referring to Waterloo County states:

"Forests and windbreaks of the county have been removed to such an extent, and the organic matter removed to such a degree, that soil drifting has become a serious problem in many areas...The policy we recommend in regard to windbreaks is to encourage the planting of desirable trees."

When proper species are used and windbreaks are correctly placed the effects are almost entirely beneficial. The effects may be direct or indirect, but in either case are the result of reduction in wind velocity. The effects of windbreaks on crops and cultivated fields may be listed as follows.

#### (a) Direct Effects

- (1) Wind damage and lodging in small grains and corn is reduced or eliminated.
- (2) Snow and the resultant moisture are more evenly distributed over fields, particularly on the higher spots where they are required most.
- (3) Wind erosion of the soil is minimized.

#### (b) Indirect Effects

- (1) Moisture loss by evaporation is reduced.
- (2) Temperatures in the fields are raised, which may prevent frost damage, accelerate growth and even lengthen the growing season slightly.
- (3) Erosion of the soil by water may be reduced by its more even distribution when released from snow.

The benefits of windbreaks to buildings in reducing heat loss in winter have been shown to be considerable. Experiments conducted in the United States proved that

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\* E. I. McLoughry. Proper Land Use Program of Waterloo County. 1950.



more than twice as much heat is lost from a house, per day or per hour, with a wind of 20 m.p.h. as with one of 5 m.p.h., and a windbreak can easily reduce wind velocities in this proportion. Used in this way they can often be made to form an effective background for the house and a protection for farm buildings. Another advantage of windbreaks is that they provide shelter and runways for insectivorous birds and small animals.

Belts of trees comprising one or two rows are usually called windbreaks, and with more than two rows, shelterbelts. In Southern Ontario windbreaks as a rule give sufficient protection except where wind erosion of soil on rolling land is severe, when shelterbelts may be required. On level land windbreaks may nearly always be established along existing fence lines, but on rolling land consideration should be given to the contour of the land. The prevailing winds in Southern Ontario are generally from the west, so that the greatest protection will be derived from windbreaks on the west side, but the placement of windbreaks on the other three sides as well should be considered.

Both the height of the trees and the wind velocity influence the effective range of a windbreak. An average windbreak will reduce the ground velocity of a 20-mile wind 10 per cent or more for a distance of about 30 times the height of the trees. About one-fourth of this effect will be felt on the windward side of the windbreak and three-fourths on the leeward side. For example, if the trees are 40 feet high the total effective range with a 20-mile wind will be  $30 \times 40$  or 1,200 feet, 300 feet of which will be on the windward side and 900 feet on the leeward side. Generally speaking, the reduction in velocity is greatest close to the windbreak and tapers out to zero further away. With higher wind velocities and/or higher trees the proportionate reduction and the effective range will be greater.



A windbreak not only reduces the velocity of wind striking it but also slightly increases the velocity of the wind diverted over, round or through it if there are gaps. The increase in velocity of winds passing over it increases its effectiveness somewhat but the increase in velocity of winds passing round or through it will increase the damage caused. For example, snow drifts will form at these points (see chapter on Snow Fences).

On level land in Southern Ontario windbreaks completely surrounding each farm of 100 acres would normally give adequate protection except for light rolling land and such wind-sensitive crops as tobacco. These should be on the west side of north-south roads, but on east-west roads would have to be carefully placed on the north or south sides, depending on the direction of the local prevailing winds. On land which is not level at least the same proportion of windbreak to area should be provided, but in many cases this would have to be adjusted according to the local topography. That is, the trees should be planted on suitable contours and where hilltops or slopes are eroding badly it will be necessary to establish plantations over a large part of the eroding area. The windbreaks should, of course, be tied in with plantations and existing woodland so that where these exist additional protection would not be required.

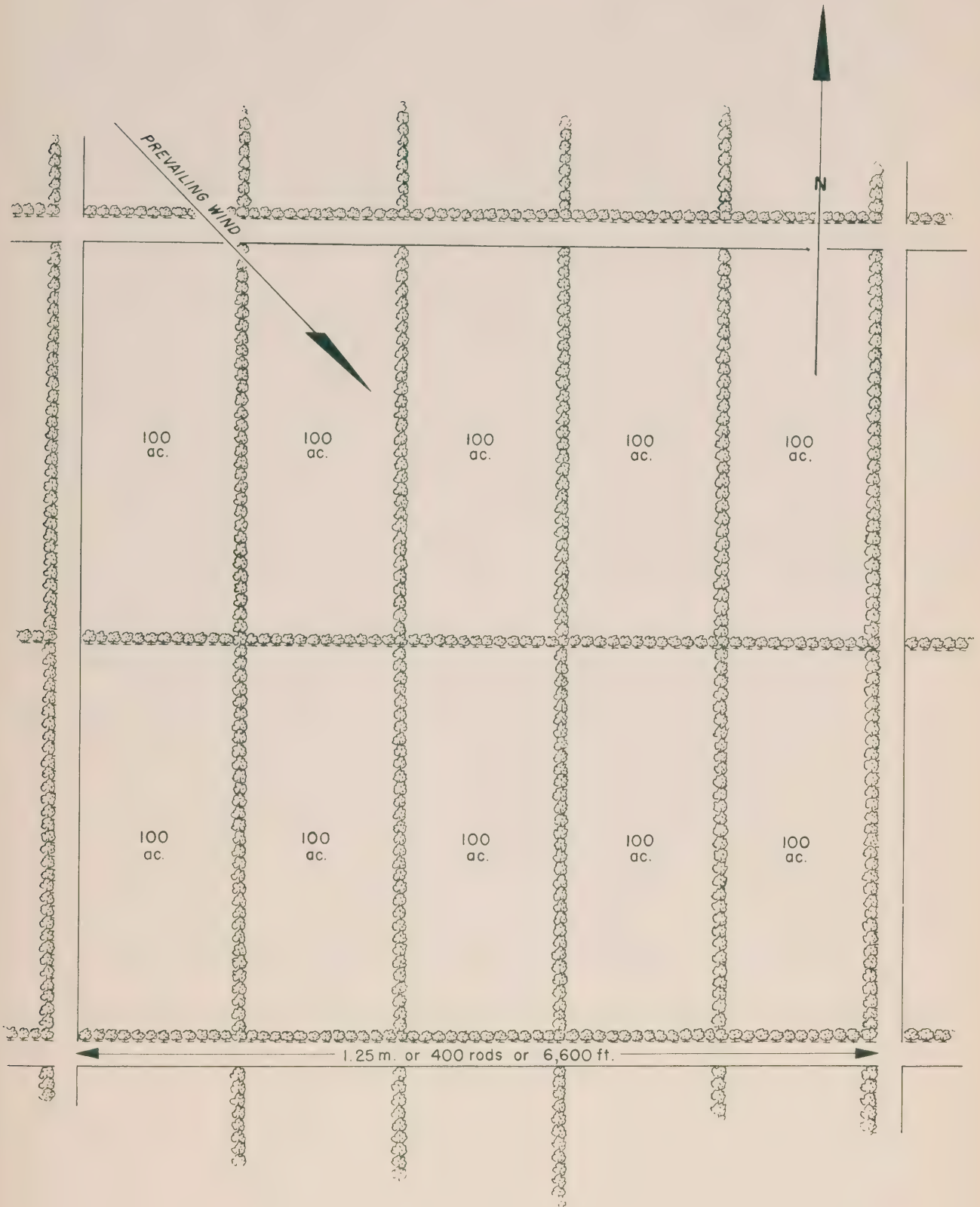
Since density, both in winter and summer, is one of the prime requisites of a good windbreak, the conifers in most instances make the best windbreaks. The slower-growing species such as white cedar and spruce give most protection, but the faster-growing ones such as the pines have the advantage of attaining more effective heights in a shorter time. A number of broad-leaved trees have fine, dense branching habits and may be nearly as effective as conifers if the branches are maintained down to the ground; among these may be included sugar maple, Chinese elm and European alder.



# WINDBREAK PLAN

for

1,000 ACRE BLOCK



This plan shows the minimum windbreak requirements for a 1,000 acre block on level land. Woodlots and plantations will replace some of this and placement will have to be adjusted according to topography and soil on rolling land.



European alder is gaining great popularity as a windbreak tree because it is a nitrogen-fixer like the legumes and does not rob the soil to the same extent as non-nitrogen-fixing species. In fact, tobacco is frequently planted close to it with little loss in size or vigour of the plants. As the robbing of the soil is one of the severest criticisms levelled against windbreaks, consideration should also be given to the planting of such leguminous trees as honey locust and caragana on certain sites.

One consideration that should be kept in mind is that under certain circumstances windbreaks may cause air stagnation, which may increase temperature and moisture conditions to a dangerous degree in summer or increase frost damage in spring and fall on small areas, particularly in hollows. Where this is likely to occur, windbreaks should be planted so as to guide the flow of air past such spots. Where these conditions develop after the windbreaks are established they may be relieved by judicious opening up of the windbreaks.

Experience has shown that windbreaks are an asset to any farm, that their adverse effects, if any, are local and easily remedied, and that in many areas they are essential to the control of soil erosion by wind. It is therefore recommended that the Authority encourage the establishment of windbreaks by private owners in every way.



CHAPTER 10  
NATIVE SHRUBS

Shrubs have a definite place in conservation. Certain species have been used successfully for controlling steep slopes and for preventing erosion of stream banks. With the growing interest in farm ponds and the accepted practice of fencing these from livestock, shrubs can serve many useful purposes along the boundaries or interspersed with trees.

While thrifty farmers like to keep their fencerows clean, especially where woven wire is used, there are still many landowners who retain their stone or rail fences overgrown with shrubs and vines for the protection of small animals or food for birds during winter. Song birds, too, in the fall before flying south, find supplementary food from this source. Also, some of our shrubs produce fruit which is prized by man for winter preserves and jelly, and in certain rural areas more than one delectable drink is made from this source.

Shrubs also have a definite horticultural appeal. Their flowers appear in many forms and a variety of colours. Their leaves, too, are often attractive during the summer and definitely so in the early autumn when the bright scarlet, purple and dark green brighten up the landscape. The fruit of many species, after the leaves have fallen, stand out in sharp contrast from the dull branches, while on some the branches themselves of yellow, green and dark red add warmth to the countryside.

A knowledge of shrubs as well as trees is an asset to one interested in conservation. For this reason, it has been considered necessary that more attention be given to this form of plant life in the surveys undertaken for the Authorities. There is no manual of shrubs for Ontario at the present time; therefore, realizing the



need for such a volume, the Department of Planning and Development is publishing, in this section of the report, a selected list of thirty native shrubs. Twenty-five shrubs were described in the Credit Valley Conservation Report 1956, and it is planned to increase this from year to year until all the shrubs and ligneous plants of the Province have been included.

While many of the shrubs described in this chapter are found on the Napanee Watershed, some are not indigenous to it and many others found thereon are not included in this second list. However, when the study is completed and published in a separate volume, this will be corrected, and by the use of the maps one may determine by counties those shrubs which are found on any particular watershed in the Province.

- A. H. Richardson.



## ANOTHER THIRTY SHRUBS OF ONTARIO

by

James H. Soper, Ph. D.  
Margaret L. Heimbürger, Ph. D.  
Leslie A. Garay

The shrubs constitute a rather prominent and interesting but little known element of our flora. Several books are available describing the trees of Ontario but no comparable treatment for shrubs has been published. For this reason a study of the native and naturalized shrubs and woody vines of our province was begun a few years ago with the ultimate objective the preparation of an illustrated manual. This project has involved both field work and herbarium studies. Field observations and collections of living plants and of pressed specimens have been made in various parts of Southern Ontario. Additional information for other parts of the province has been obtained from a study of specimens preserved in both institutional and private herbaria. These include the herbaria at the Universities of Toronto, Western Ontario, McMaster and Queen's, the Ontario Agricultural College at Guelph, the National Herbarium of Canada and the Department of Agriculture, Science Service, at Ottawa.

This is the second of a series\* and covers thirty shrubby representatives of four families which have been studied, described and illustrated. The plan is to continue publishing on the other groups of shrubs as they are studied and then to issue the complete series with keys for the identification of the genera and species. For each species studied there is a description, an illustration, and a map which shows the distribution in Southern Ontario as far as it is known from the available records.

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\* The first publication in this series, entitled "Twenty-five Shrubs of Southern Ontario" by Soper, Heimbürger & Garay, appeared in Chapter 8, Forestry Section, Credit Valley Conservation Report, issued May 24, 1956, by the Ontario Department of Planning and Development.



The descriptions have been prepared with a view to emphasizing the vegetative characters of each species, particularly the arrangement and shape of the leaves. At the end of each description a Field Check is given which calls attention to the more significant diagnostic characters of that species. In the group here presented there are three genera, Cornus (the DOGWOODS), Viburnum (the VIBURNUMS), and Lonicera (the HONEYSUCKLES), each of which has seven or eight native or naturalized species in Ontario. For these genera a brief note on their common characters is first given, followed by a key for the identification of the species and then the individual illustrations, maps and descriptions, each ending with a Field Check. In order to reduce the Field Check to about three salient points, the common characters given as a Field Check for the genus are not repeated for each species. Measurements are based on the specimens available in the Herbarium of the Department of Botany at the University of Toronto, where this study is being conducted. Nomenclature and the spelling of names follow the 8th edition of Gray's Manual by M.L. Fernald, published in 1950.

The thirty illustrations for this section have been prepared by the junior author working from pressed herbarium specimens. It was felt that line drawings would express more clearly the diagnostic features such as leaf shape, venation, and marginal toothing than either photographs or three-dimensional sketches. The leafy branch which forms the main portion of each illustration appears at one-half the natural size. The smaller drawings of the details such as flower, fruit, leaf surface and leaf margin are at various magnifications.

The maps have been prepared from information on file in the Catalogue of Vascular Plants of Ontario compiled by the two senior authors. Each dot on a map represents either a specimen preserved in some herbarium, a field observation, a published report or other acceptable evidence of the



occurrence of that particular plant in the locality shown. In the present group of species there are no maps for Viburnum edule and Lonicera involucrata because these two species are unknown as native shrubs in the area covered by the base map used for Southern Ontario and insufficient data are available as yet to warrant the publication of a separate map for the northern part of the province. An introductory map has been included as a reference, giving a key to the names of the counties and districts in Southern Ontario as well as one floristic and two geological boundaries which have a significance in relation to the distribution of plants. The numbers of the counties and districts follow the system used by Baillie & Harrington in the Transactions of the Royal Canadian Institute, Vol. XXI, Part I, published in 1937.

The Carolinian Zone is the region along the north shore of Lake Erie north to a sinuous line running approximately from Grand Bend on Lake Huron through London, Tillsonburg and Galt to Toronto on Lake Ontario. It is a well known floristic area or forest region in Canada, a northern strip of the Deciduous Forest in which many species of southern trees and shrubs are common and in which numerous other woody and herbaceous species of southern affinity reach their northern limit or have their major Canadian distribution.

One of the geological boundaries shown on the map is the Niagara Escarpment, which is a very prominent topographic feature of our landscape. It is a set of cliffs capped by limestones and dolomites entering Ontario at Queenston on the Niagara River and extending west to Hamilton and then north-west to the Bruce Peninsula and continued on Manitoulin Island. A number of calcicolous plants are found closely associated with the basic soils which accompany this long series of rock exposures and talus slopes. The other geological boundary is that between the two main types of bedrock which underlie the glacial deposits and soils in Southern Ontario. The extensive geological formation known





## COUNTIES and DISTRICTS

### Counties

1. ESSEX
2. KENT
3. LAMBTON
4. ELGIN
5. MIDDLESEX
6. NORFOLK
7. OXFORD
8. BRANT
9. HALDIMAND
10. WELLAND
11. LINCOLN
12. WENTWORTH
13. WATERLOO
14. PERTH
15. HALTON
16. HURON
17. WELLINGTON
18. PEEL
19. YORK
20. DUFFERIN
21. ONTARIO
22. DURHAM
23. NORTHUMBERLAND
24. PRINCE EDWARD
25. BRUCE
26. GREY

27. SIMCOE
28. VICTORIA
29. PETERBOROUGH
30. HASTINGS
31. LENNOX & ADDINGTON
32. FRONTENAC
33. LEEDS
34. GRENVILLE
35. DUNDAS
36. STORMONT
37. GLENGARRY
38. PRESCOTT
39. RUSSELL
40. CARLETON
41. LANARK
42. HALIBURTON

### Districts

43. MUSKOKA
44. PARRY SOUND
45. RENFREW
46. MANITOULIN
47. NIPISSING
48. ALGOMA
49. SUDBURY



as the Precambrian or Canadian Shield, characterized by granites and gneisses, comes down across Southern Ontario to the region of the Thousand Islands on the St. Lawrence River, where it passes into the State of New York. The area south and west of the Canadian Shield, including the Bruce Peninsula and Manitoulin Island, is underlain by sedimentary rocks of Palaeozoic age, chiefly limestones and dolomites. A similar but smaller section of the Palaeozoic underlies the eastern counties of Ontario between the St. Lawrence and the Ottawa rivers. In the case of those plants which seem to have a preference for either acid or basic soils the position of the boundary between the Precambrian and Palaeozoic rocks often shows a relation to the actual distribution of the species concerned.

The authors wish to express their gratitude to Mr. A. H. Richardson, Chief Conservation Engineer of the Department of Planning and Development, who suggested and initiated this project and has facilitated its progress in many ways. Financial support for field work, visits to herbaria and the employment of assistants in the field and in the herbarium have come from several sources. Grateful acknowledgement is hereby made to the Department of Planning and Development, the former Research Council of Ontario, the Ontario Research Foundation and the University of Toronto.

The authors would be very glad to receive information concerning errors, omissions, or additional distribution records from anyone using this publication.

James H. Soper

Department of Botany,  
University of Toronto.

June 1, 1957.



# THIRTY SHRUBS DESCRIBED

<u>Family</u>	<u>Genus and Species</u>	<u>Common Name</u>	<u>Shrub No.</u>
PINACEAE	<u>Juniperus communis</u> var. <u>depressa</u>	Common Juniper	2
	<u>Juniperus horizontalis</u>	Creeping Juniper	3
CORNACEAE	<u>Cornus alternifolia</u>	Pagoda Dogwood	27
	<u>Cornus Drummondii</u>	Rough-leaved Dogwood	28
	<u>Cornus florida</u>	Flowering Dogwood	29
	<u>Cornus obliqua</u>	Silky Dogwood	30
	<u>Cornus racemosa</u>	Gray Dogwood	31
	<u>Cornus rugosa</u>	Round-leaved Dogwood	32
	<u>Cornus stolonifera</u>	Red Osier	33
BIGNONIACEAE	<u>Campsis radicans</u>	Trumpet Creeper	34
CAPRIFOLIACEAE	<u>Sambucus canadensis</u>	American Elder	36
	<u>Sambucus pubens</u>	Red-berried Elder	37
	<u>Viburnum acerifolium</u>	Maple-leaved Viburnum	38
	<u>Viburnum alnifolium</u>	Hobblebush	39
	<u>Viburnum cassinoides</u>	Withe-rod	40
	<u>Viburnum edule</u>	Squashberry	41
	<u>Viburnum Lentago</u>	Nannyberry	42
	<u>Viburnum Rafinesquianum</u>	Downy Arrow-wood	43
	<u>Viburnum recognitum</u>	Southern Arrow-wood	44
	<u>Viburnum trilobum</u>	Highbush Cranberry	45
	<u>Symphoricarpos albus</u>	Snowberry	46
	<u>Symphoricarpos occidentalis</u>	Wolfberry	47
	<u>Lonicera canadensis</u>	Fly-Honeysuckle	48
	<u>Lonicera dioica</u>	Glaucous Honeysuckle	49
	<u>Lonicera hirsuta</u>	Hairy Honeysuckle	50
	<u>Lonicera involucrata</u>	Bracted Honeysuckle	51
	<u>Lonicera oblongifolia</u>	Swamp Fly-Honeysuckle	52
	<u>Lonicera tatarica</u>	Tartarian Honeysuckle	53
	<u>Lonicera villosa</u>	Mountain Fly-Honeysuckle	54
	<u>Diervilla Lonicera</u>	Bush Honeysuckle	55

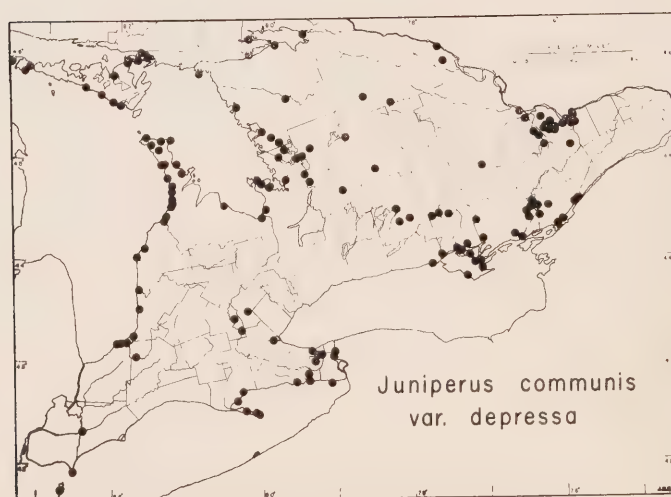






*Juniperus communis* Linnaeus var. *depressa* Pursh

COMMON JUNIPER



Juniperus communis Linnaeus var.  
depressa Pursh

COMMON JUNIPER,  
GROUND JUNIPER

Habit - The Common Juniper is a low erect or spreading shrub rarely over 5 feet in height with erect or ascending stiff branches, but usually without a main central stem. It often forms broad patches which gradually die off from the centre.

Twig - The young branchlets are smooth and greenish to pale brown, soon becoming ridged and dark brown with scaly bark.

Leaf - The evergreen leaves (needles) are awl-shaped, 1-2 -  $\frac{3}{4}$  inch long and  $\frac{1}{16}$  inch or less in width at the rounded base, gradually tapered to a slender spine-like tip. The needles are borne in stiff whorls of three along the stem and are wide-spreading on the older branches. Each needle is usually curved towards the jointed base and concave on the upper (inner) surface with a broad bluish-white stripe down the middle bordered by green on each side. The lower surface is pale to dark green.

Flower - There are separate male and female flowers, usually borne on the same plant. The male flower (shown enlarged) is a small catkin-like cluster of stamens borne in two's or three's around a central stalk with several small scales at the base. The female flower consists of a tight cluster of 3-8 small pointed scales, some or all of which bear one or two ovules. Both types arise in the axils of the leaves of the previous year's growth and open in May or June.

Fruit - After fertilization the scales of the female flower become fleshy and grow together to form a round blue-black berry-like mass enclosing 1-3 seeds. These berry-like fruits are  $\frac{1}{4}$  -  $\frac{3}{8}$  inch across, aromatic, usually covered with a waxy bluish-white bloom and mature during the third season.

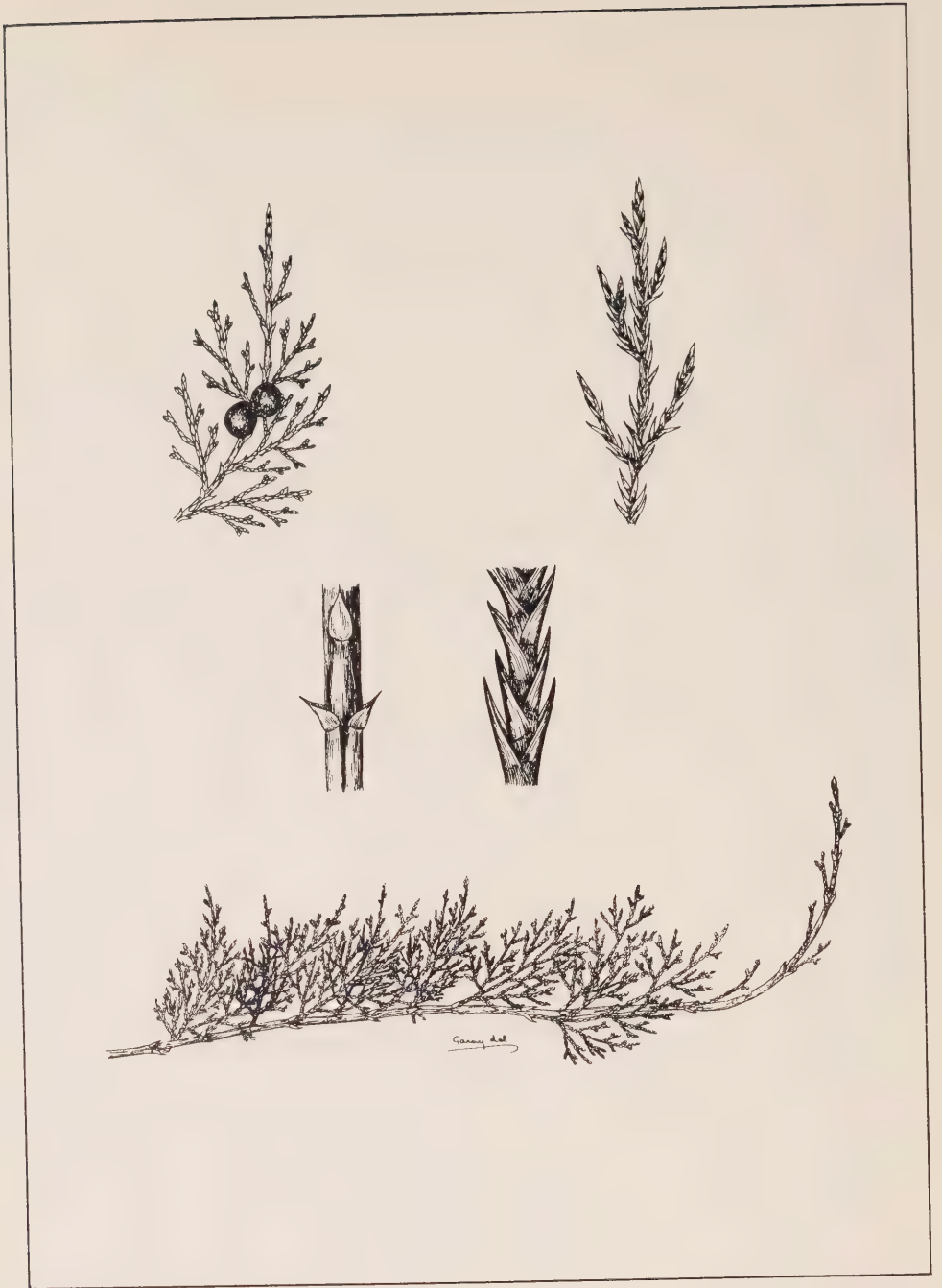
Habitat - Along sandy or rocky shores and banks, in open woods, clearings and old fields.

Range - From the shores of Lake Erie, Lake Ontario and the St. Lawrence River to the north shore of Lake Superior and James Bay. (Newfoundland to Alaska, south to California and Virginia.)

FIELD CHECK - Low stiff-branched shrub; spine-tipped evergreen needles in three's; blue "berries" with a bloom.

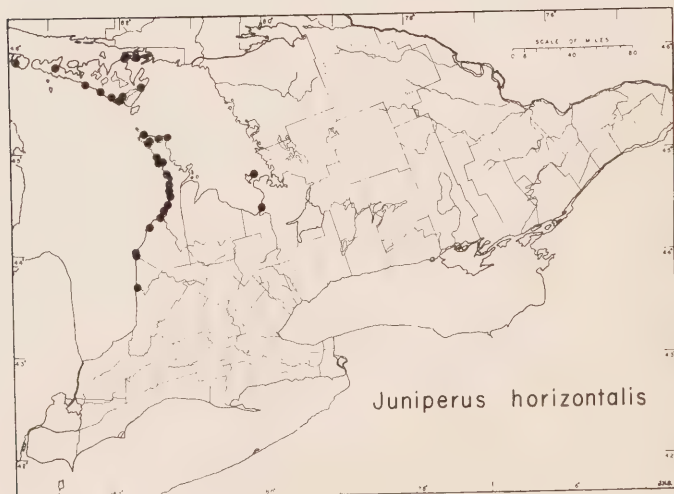






*Juniperus horizontalis* Moench

CREeping JUNIPER



Habit - The Creeping Juniper is a prostrate shrub with a long trailing stem and many short erect or ascending branches.

Twig - The young branches are greenish-brown and covered with numerous scale-like leaves, the older stems becoming reddish-brown to blackish with scaly peeling bark.

Leaf - The evergreen leaves are small, normally scale-like and arranged in pairs which alternate at right angles along the stem (decussate), closely appressed and overlapping to cover the slender branchlets (shown at upper left), forming a diamond-shaped pattern with their exposed triangular tips. This species is a host for a fungus (Gymnosporangium juvenescens) which causes a Witches-broom effect and the leaves on infected plants (shown at upper right) are commonly awl-shaped, up to 3/16 inch long, sharp-pointed and strongly folded inwards on the upper surface, their free tips spreading outwards slightly and their bases decurrent along the stem. These sharp-pointed leaves are sometimes mistaken for juvenile foliage, which consists of awl-shaped leaves.

Flower - There are separate male and female flowers, usually borne on the same plant. The male flower is a tiny cone-like cluster of umbrella-shaped stamens. The female flower is a tight round cluster of 3-8 small pointed scales, some or all of which bear one or two ovules. Both types arise at the ends of short branchlets and open in May or June.

Fruit - After fertilization the scales of the female flower become fleshy and grow together to form a round or irregular blue berry-like mass enclosing 3-5 seeds. The berry-like fruits are 1/4 - 3/8 inch across, borne on short curved stalks and ripen the second summer.

Habitat - On sand dunes, sandy or rocky shores, open rocky woods, slopes and pastures.

Range - Shores of Lake Huron, Georgian Bay and Lake Superior, north to James Bay. (Newfoundland to Alaska, south to Wyoming and New England).

FIELD CHECK - Prostrate trailing shrub with many short branches; opposite appressed scale-like leaves; blue "berries" on short curved stalks.



## THE DOGWOODS (Cornus)

The Dogwoods are medium-sized shrubs with entire, simple, usually opposite leaves in which the veins curve prominently towards the tip. The flowers are small, whitish or yellowish, perfect and four-parted, borne in showy cymes. The fruits are fleshy berry-like white or coloured drupes with a one- or two-seeded stone in the middle.

The Alternate-leaved Dogwood (Cornus alternifolia) and the Flowering Dogwood (C. florida) may grow with a single main stem, then becoming a small tree with somewhat horizontal or tiered branching. The leaves and branches are opposite in all species except the Alternate-leaved Dogwood. The flowers are stalked and in loose or open clusters except in the Flowering Dogwood which has a small dense cluster of sessile flowers surrounded by four large petal-like bracts.

FIELD CHECK - Branches and leaves usually opposite; leaves entire with veins curving prominently towards the tip; cymes of four-parted flowers; one- or two-seeded berry-like fruits.

### Key to Species

- a. Stems with alternate branching; leaves alternate or a few nearly opposite, often crowded (appearing whorled) near the ends of the branches. . . . . 1. C. alternifolia
- a. Stems with opposite branching; leaves all opposite and scattered along the stem or in one or two regular pairs near the ends of the branches. . . b.
  - b. Flowers sessile, surrounded by four large white petal-like bracts; fruits ellipsoid, shiny red, in stalked dense clusters. . . . . 2. C. florida
  - b. Flowers stalked, not surrounded by showy bracts; fruits globose. . . c.
    - c. Pith of two-year old branches white; stems greenish; reddish or purplish. . . d.
      - d. Stems greenish, reddish or purplish; leaves lanceolate to ovate; fruits white or bluish-tinged. . . . . 3. C. stolonifera
      - d. Stems green, warty, usually dotted or streaked with purple; leaves broadly oval to nearly orbicular; fruits pale blue to greenish-white. . . . . 4. C. rugosa
    - c. Pith of two-year old branches usually brown or at least a little darker than the wood, that of the current growth sometimes white; stems greenish or gray to brown. . . e.
      - e. Flowers in an elongate round-topped cluster; fruits white, usually on bright red stalks. . . . . 5. C. racemosa
      - e. Flowers in a flat-topped or barely rounded cluster wider than long; fruits white or blue on green or purplish stalks. . . f.
        - f. Leaves often drooping on arching petioles, smooth above; fruits blue or bluish-white on green stalks. . . . . 6. C. obliqua
        - f. Leaves not drooping, rough on the upper surface; fruits white on purplish stalks. . . . . 7. C. Drummondii

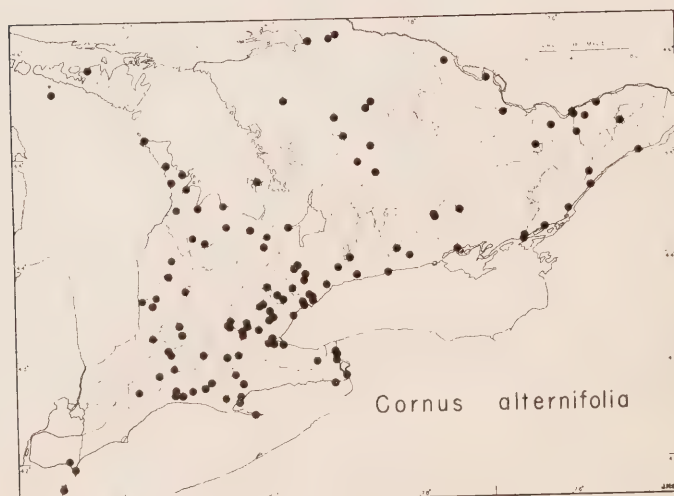






*Cornus alternifolia* Linnaeus filius

ALTERNATE-LEAVED DOGWOOD



Cornus alternifolia Linnaeus filius    ALTERNATE-LEAVED DOGWOOD,  
PAGODA DOGWOOD,  
GREEN OSIER

Habit - The Alternate-leaved Dogwood is a large shrub or a small tree growing to a height of 15 or 20 feet. The tree form is similar to that of the Sassafras, with horizontal tiers or platforms, the side branches longer than the main stem and with wide-spreading upcurved tips.

Twig - The twigs are greenish-red to purple or brownish and glossy with slender white pith. The branching is alternate, which distinguishes this species from all our other Dogwoods.

Leaf - The leaves are alternate, simple and deciduous, frequently so crowded near the ends of the branches as to appear opposite or whorled. The blade is rather thin, ovate or oval, 1-1/2 - 5 inches long and 1 - 3 inches wide, with a pointed tip and a rounded or narrowed base, dark green above, grayish and finely hairy below. The slender petiole may be very short or as much as 2 1/2 inches in length.

Flower - The flowers are small, creamy-white and numerous in large flat-topped clusters, opening about the middle of June.

Fruit - The fruits, which ripen in July or August, are round dark berry-like drupes with a bloom, each about 1/4 inch across and borne on a red stalk.

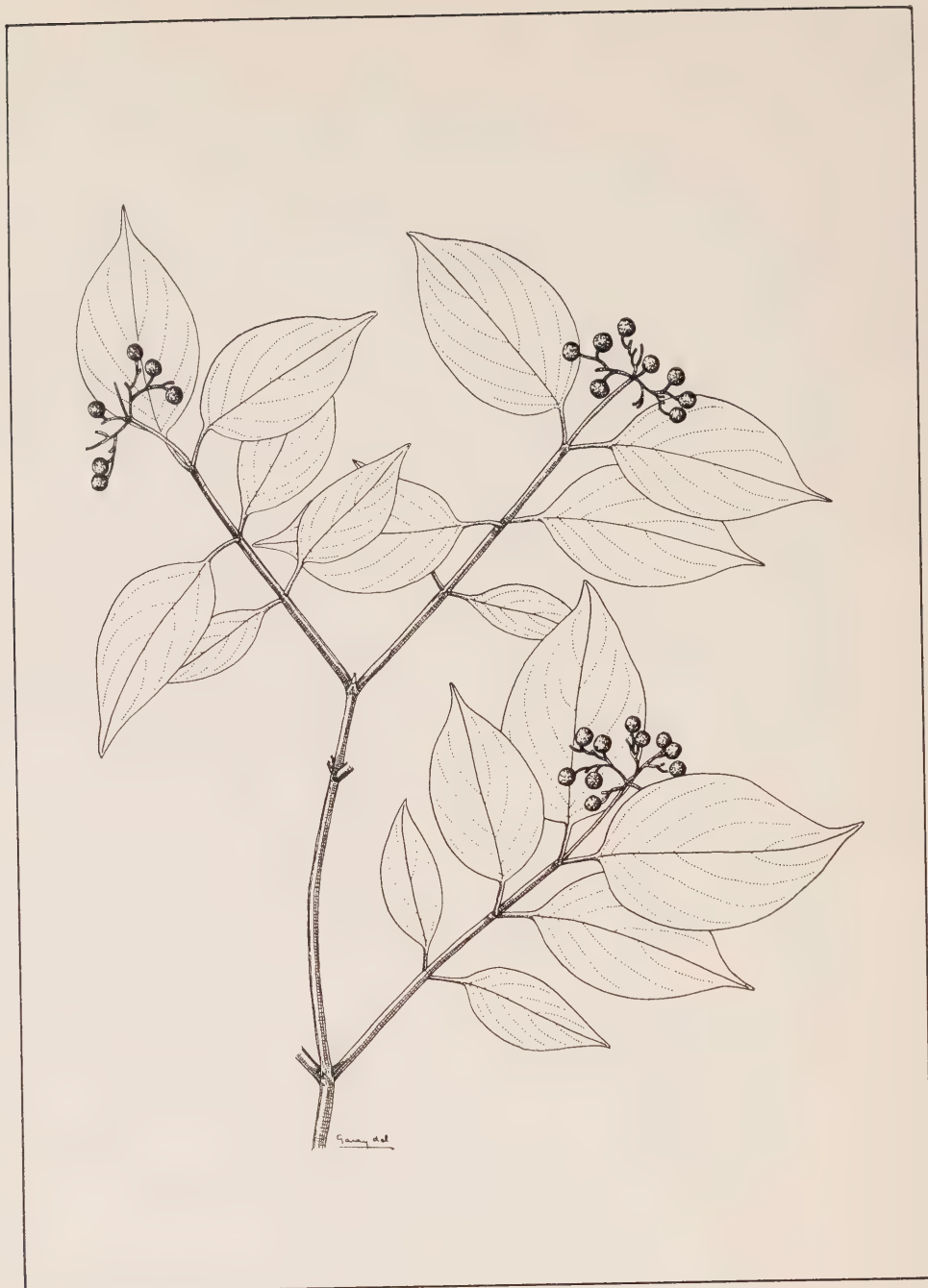
Habitat - In thickets or open woods, on hillsides and ravine slopes.

Range - Common in southern Ontario and as far north as the north shore of Lake Superior. (Newfoundland to Minnesota, south to Alabama and Missouri).

FIELD CHECK - Alternate branching; leaves alternate, often crowded near the ends of the branches; dark blue berries on red stalks.

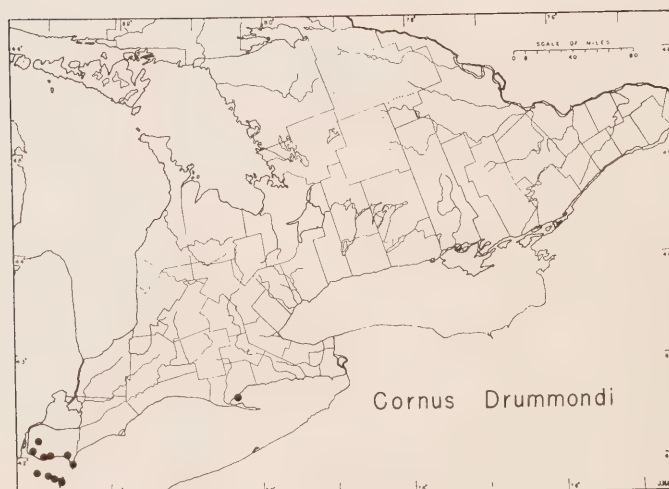






*Cornus Drummondii* Meyer

ROUGH-LEAVED DOGWOOD



Habit - The Rough-leaved Dogwood is an erect much-branched shrub up to 10 or 15 feet in height, sometimes forming thickets.

Twig - The branchlets are reddish and minutely downy at first, becoming brownish to gray and smooth. The pith is slender, brown or rarely white.

Leaf - The leaves are opposite, simple and deciduous. The blade varies from lanceolate or narrowly oval to broadly ovate, 2 - 3-1/2 inches long and 1 - 2 inches wide, long-tapering and sometimes slightly folded at the apex and rounded, tapering or rarely cordate at the base, dark green and definitely roughened above, paler and finely woolly below. The downy petiole is 1/4 - 3/4 inch long.

Flower - The flowers, which open towards the end of June, are small, creamy-white and numerous in loose cymes.

Fruit - The fruits, which ripen in August, are white berry-like drupes each about 1/4 inch across and borne on a purplish-red stalk.

Habitat - In sandy or clay soil along the edge of woods or near shores of lakes and streams.

Range - Apparently confined to Essex and Norfolk counties in southern Ontario. (Ohio to Nebraska, south to Texas.)

FIELD CHECK - Taper-pointed leaves rough above, paler and woolly beneath; white berries on purplish-red stalks.

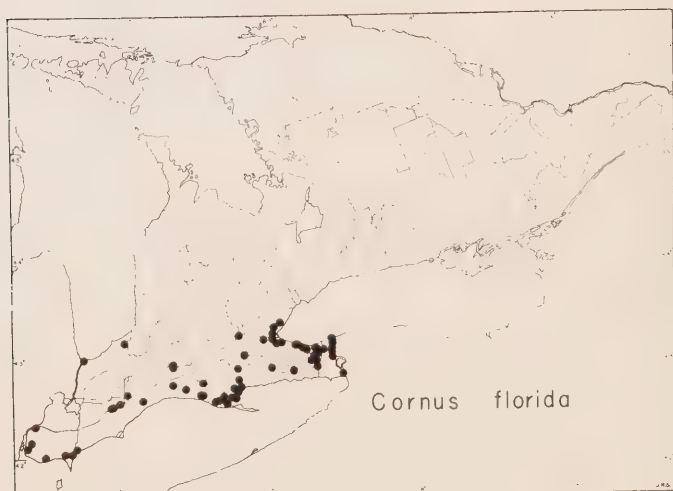






*Cornus florida* Linnaeus

FLOWERING DOGWOOD



Habit - The Flowering Dogwood is an erect shrub up to 10 or 15 feet in height but it also grows as a small tree to 30 feet or more with a single trunk and the branches more or less in horizontal whorls or tiers.

Twig - The branchlets are greenish becoming reddish with a scattering of fine white hairs. The bark on older stems and trunks is dark reddish-brown to blackish, broken up into small angular or rounded scales.

Leaf - The leaves are opposite, simple and deciduous, mostly borne in one or two pairs at the ends of the branches. The blade is ovate or elliptic to broadly oval, 2 - 5-1/2 inches long and 1 - 3 inches wide, rather thin, light to dark green above and pale grayish-green below. The tip is pointed and the base rounded or tapered with a slender petiole usually less than one inch long. In the fall the leaves turn a brilliant scarlet, reddish-brown or bronzy-green.

Flower - The flowers are small, greenish-yellow or whitish, borne in dense clusters surrounded by four large petal-like white or pinkish deciduous bracts (the expanded flower bud-scales) which make the small clusters very conspicuous and attractive. The bracts are broadly obovate to obcordate, 1 - 2 inches long, usually with a red or purplish notch at the free end. The flowers open during the latter part of May as the leaves are expanding.

Fruit - The fruits which are borne in prominently stalked tight clusters and ripen in August or September, are shiny red berry-like drupes, each ovoid in shape and about 1/2 inch long, beaked with the persistent calyx lobes. Each cluster has several undeveloped fruits mixed with the mature ones.

Habitat - In acid soils, usually on the edge of sandy or wet woodland, in open woods and on ravine slopes.

Range - Restricted to the Carolinian Zone in southern Ontario. (Southwestern Maine to Illinois, south to Florida and Mexico.)

FIELD CHECK - Leaves often in 1 or 2 pairs at ends of branches; attractive 4-bracted flower clusters; stalked dense clusters of shiny red ovoid berries.

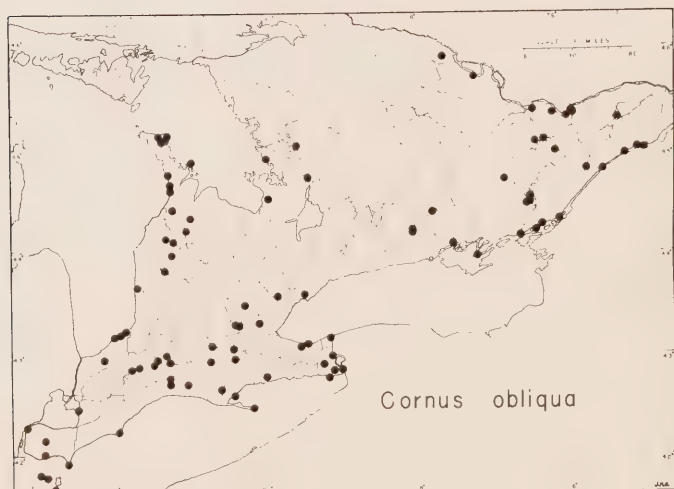






*Cornus obliqua* Rafinesque

SILKY DOGWOOD



Habit - The Silky Dogwood is an upright or spreading shrub up to 10 feet in height with rather open branching.

Twig - The young twigs are grayish and finely hairy, but later become smooth and reddish to purplish-brown. The pith is slender and brown.

Leaf - The leaves are opposite, simple and deciduous. The blade is lanceolate-elliptic to oval, 2 - 4 inches long and 1/2 - 2 inches wide, usually less than half as broad as long, long-tapered at the apex and gradually tapered or barely rounded at the base, dark green above, pale grayish-green, finely appressed-hairy and microscopically papillose below. The petioles are about 3/4 inch or less in length, often arching and causing the leaves to droop.

Flower - The flowers, which open about the first of July, are small and creamy-white, borne in nearly flat-topped pubescent cymes. This is the latest flowering of our native Dogwoods.

Fruit - The fruits, which ripen in late August or September, are round blue or bluish-white berry-like drupes 1/4 - 3/8 inch across.

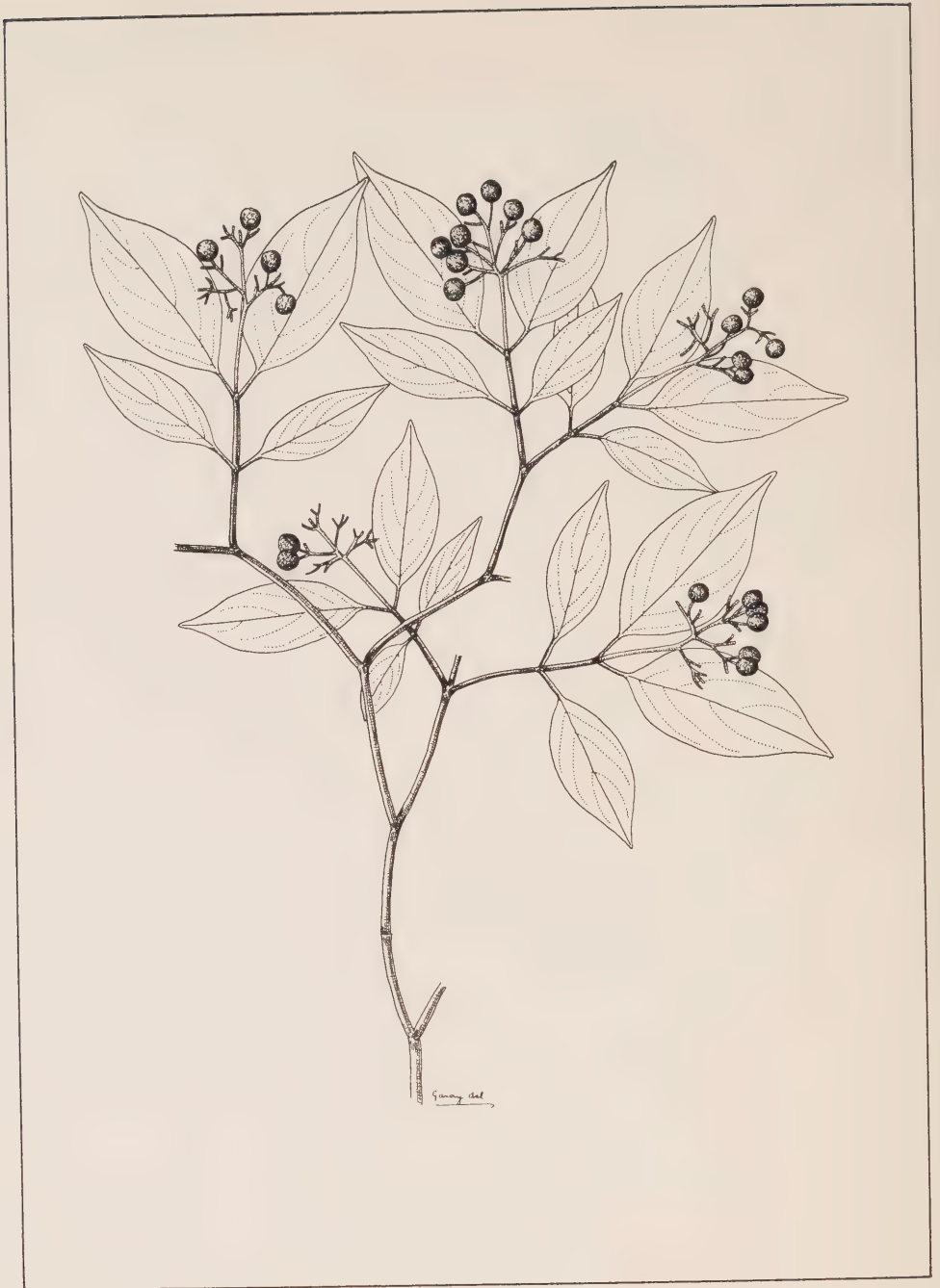
Habitat - In low damp ground along streams and in marshes, ditches, thickets, and open woods.

Range - Common south of the Canadian Shield in southern Ontario, north to Georgian Bay. (New Brunswick to North Dakota, south to Oklahoma and West Virginia.)

FIELD CHECK - Slender brown pith; narrow long-pointed often drooping leaves on arching petioles; bluish-white berries.

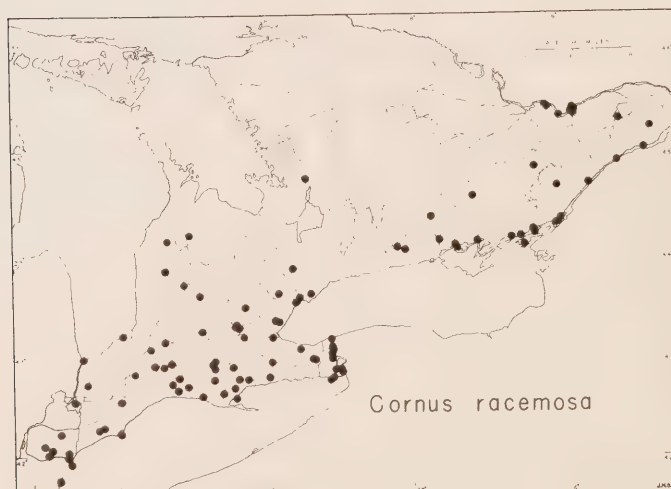






*Cornus racemosa* Lamarck

GRAY DOGWOOD



Habit - The Gray Dogwood is an erect much-branched shrub up to 8 feet in height commonly forming compact thickets.

Twig - The branchlets are slender, smooth and gray to light brown. The pith is slender, pale brown or white.

Leaf - The leaves are rather numerous, opposite, simple and deciduous. The blade is elliptic or narrowly oval, 2 - 4 inches long,  $3/4$  -  $1-1/2$  inches wide, dark green above, gray-green and minutely hairy below, with a long tapered apex and the base wedge-shaped or tapered to a petiole  $1/4$  -  $1/2$  inch long.

Flower - The flowers are small, creamy white and ill-scented, opening towards the end of June. They are borne in loose elongate cymes nearly as high as broad.

Fruit - The fruits, which ripen in August, are round white berry-like drupes each less than  $1/4$  inch across, usually borne on bright red stalks.

Habitat - In thickets along river-banks, sandy slopes, limestone ledges, roadsides and fencerows, or in low open ground.

Range - Common in southern Ontario south and east of the Canadian Shield. (Maine to Minnesota, south to Oklahoma and Kentucky.)

Field Check - Much-branched and densely leafy; gray branchlets; elongate roundtopped inflorescence; white berries on red stalks.

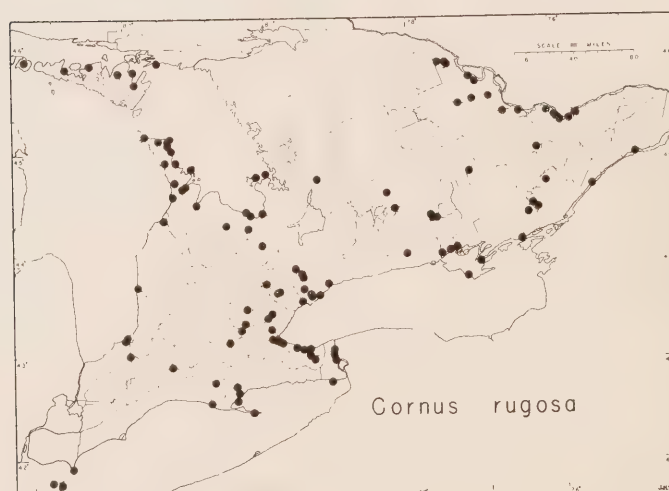






*Cornus rugosa* Lamareck

ROUND-LEAVED DOGWOOD



Habit - The Round-leaved Dogwood is a coarse erect shrub, sometimes becoming a little tree-like, growing to a height of about 10 feet.

Twig - The young branchlets are warty, pinkish to yellowish-green, dotted or streaked with purple or reddish-brown, the older stems purplish. The pith is large and white.

Leaf - The leaves are opposite, simple and deciduous. The blade is broadly oval to nearly round, 3 - 6 inches long and 2 - 4-1/2 inches wide, abruptly pointed at the tip and broadly rounded at the base, pale to dark green and rough above, grayish below with a dense felt-like covering of short woolly hairs. The petiole 1/2 - 3/4 inch long.

Flower - The flowers, which open towards the end of June, are small, white to creamy-white, borne in dense flat-topped cymes.

Fruit - The fruits which ripen in August are round pale blue to greenish-white berry-like drupes, each 1/4 inch or less in diameter.

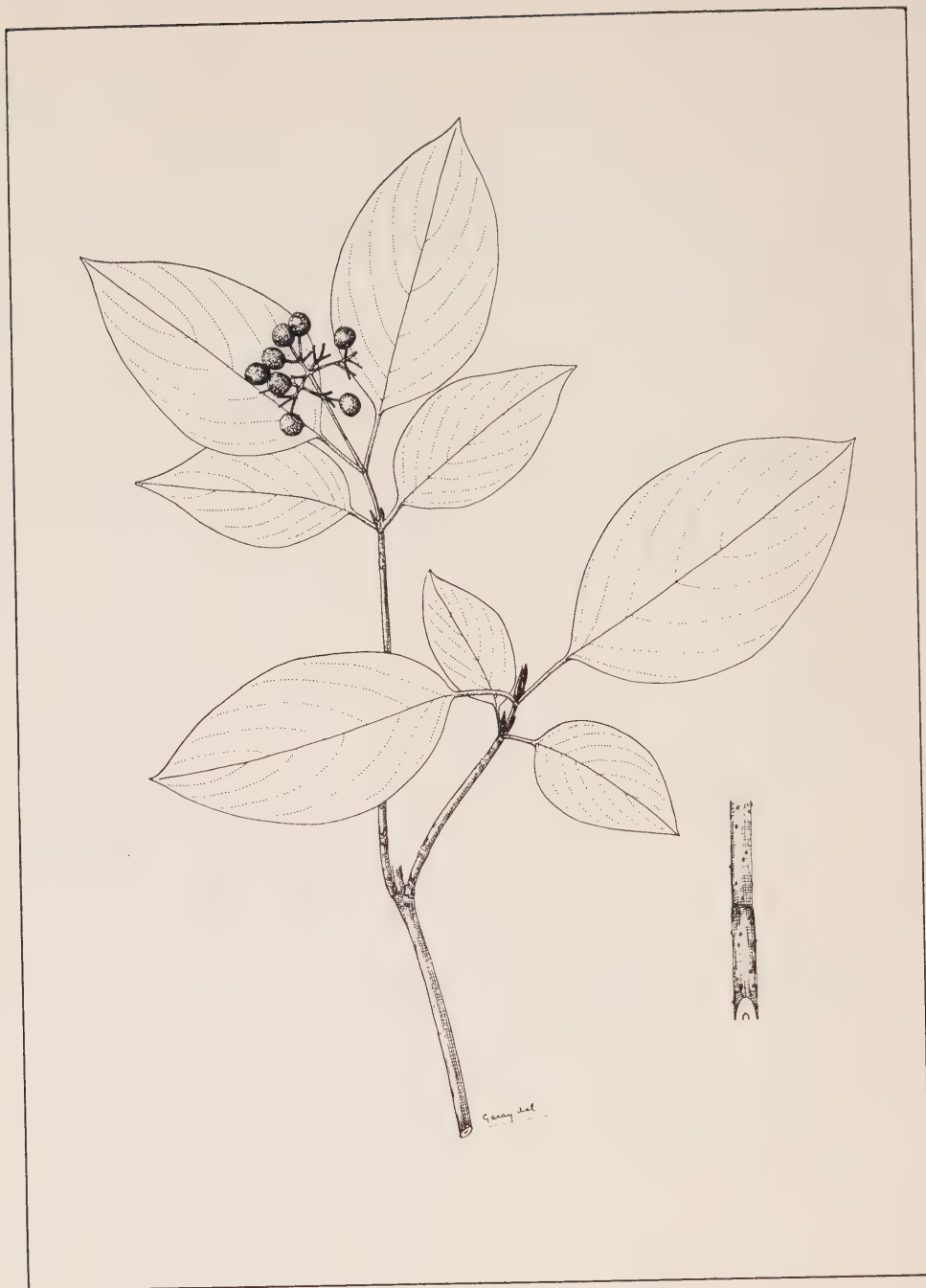
Habitat - In sandy, gravelly or rocky soil, on limestone talus and ledges, in open woods, thickets, and on slopes of ravines.

Range - In southern Ontario especially common along the Niagara escarpment, north to Manitoulin, Algoma, Timiskaming, Thunder Bay and Rainy River districts. (Quebec to Manitoba, south to Iowa and Virginia.)

Field Check - Stems green dotted or streaked with purple; leaves broadly rounded, rough above and gray-hairy below; berries pale blue to greenish-white.

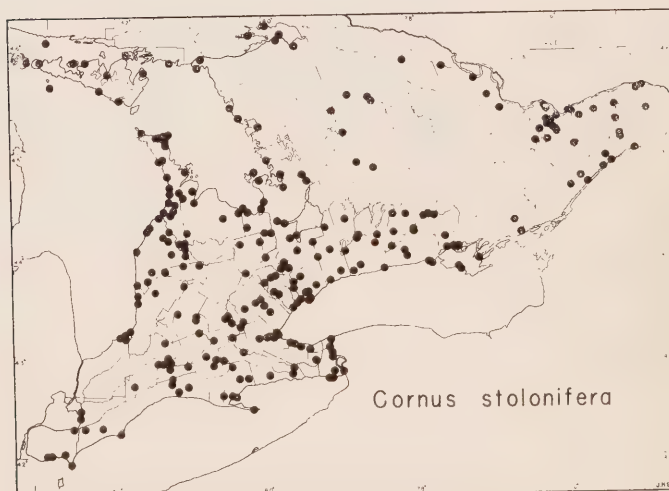






*Cornus stolonifera* Michaux

RED OSIER



Habit - The Red Osier is an erect, ascending, or loosely spreading shrub with the branches often prostrate and freely rooting, commonly forming thickets.

Twig - The young branchlets are green and finely hairy, soon becoming smooth and purplish to bright red. The pith is large and white.

Leaf - The leaves are opposite, simple and deciduous. The blade is lanceolate-ovate to broadly oval, 2 - 6 inches long and 1 - 3-1/2 inches wide, tapered or abruptly short-pointed at the tip and rounded or narrowed at the base, dark green above, paler to whitened and finely to densely soft-hairy beneath. The petiole is 1/4 - 1 inch in length.

Flower - The flowers, which open towards the end of June, are small and dull white, borne in flat-topped or slightly rounded cymes.

Fruit - The fruits which ripen in August or September, are round berry-like drupes, 1/4 inch or more in diameter, usually white or bluish-tinged, rarely lead-coloured.

Habitat - In low damp ground, along shores, river flats, edges of marshes, in damp open woods and thickets, and along roadsides where the red stems are conspicuous in winter and early spring.

Range - Common throughout southern Ontario and north to James Bay. (Newfoundland to the Yukon, south to California and West Virginia.)

Field Check - Spreading stoloniferous habit; reddish stems with large white pith; white or bluish-tinged berries.

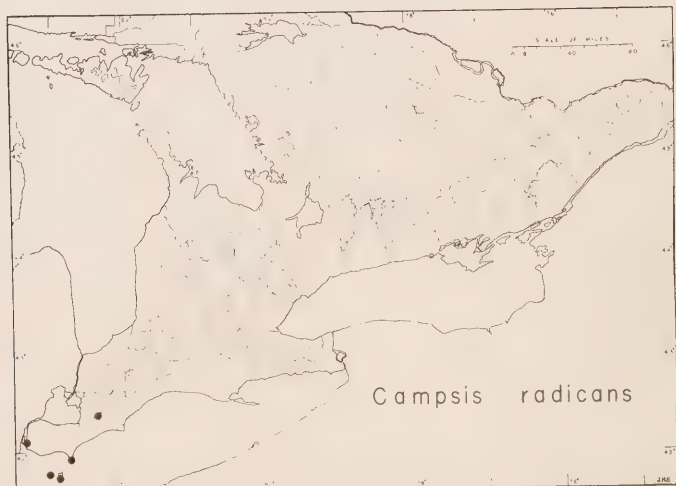






*Campsis radicans* (Linnaeus) Seeman

TRUMPET CREEPER



Habit - The Trumpet Creeper is a vigorous scrambling shrub or high-climbing woody vine adhering to tree trunks by means of aerial roots.

Twig - The branchlets are green or reddish, smooth or minutely downy at first, with a fringe of hairs across the stem at the base of each pair of leaves.

Leaf - The large opposite leaves are pinnately compound and deciduous. Each leaf is long-petioled with 7 - 13 (usually 9 or 11) stalked leaflets which are ovate or ovate-lanceolate, 1-1/2 - 3 inches long, 1/2 - 1-1/2 inches wide, coarsely toothed, smooth and bright green above, a little paler and smooth or hairy along the veins beneath.

Flower - The orange-red flowers are borne in conspicuous crowded clusters at the ends of gracefully curved branches and open in July or early August. Each flower is trumpet-shaped, 2 - 3-1/4 inches long, with five spreading and slightly irregular lobes.

Fruit - The fruit is a thick pod 4 - 6 inches long with convex sides. There is a prominent partition down the middle and several rows of winged seeds on each side.

Habitat - In sandy soil of clearings and edges of woods, climbing over conifers and up the trunks of deciduous trees; also escaping to roadsides and fencerows.

Range - Indigenous only along the Lake Erie shore of Essex County and on the Erie Islands near Point Pelee; formerly in the Chatham area of Kent county. Frequently planted as an ornamental vine as far north as Georgian Bay but barely hardy in the Ottawa District. (New Jersey to Illinois, south to Texas and Florida.)

Field Check - Woody climber with aerial roots; opposite pinnately compound leaves; orange-red trumpet-shaped flowers; long thick pods with winged seeds.

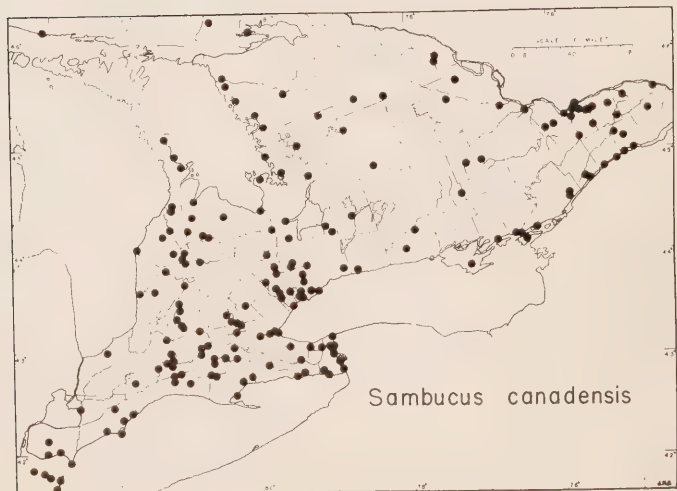






*Sambucus canadensis* Linnaeus

AMERICAN ELDER



Habit - The American Elder is an erect soft-stemmed or barely woody and somewhat stoloniferous shrub growing to a height of about 10 feet.

Twig - The young branchlets are yellowish-gray and smooth or nearly so. The twigs are stout with warty gray-brown bark and large white pith.

Leaf - The leaves are large, opposite, pinnately compound and deciduous, with a petiole 1 - 2 inches long. The 5 - 11 (usually 7) sessile or short-stalked leaflets are elliptic, 2 - 6 inches long and 1 - 2-1/4 inches wide, sharply serrate, abruptly and conspicuously sharp-pointed and rounded or tapered, frequently asymmetrical, at the base, bright green above and paler, mostly smooth or a little hairy along the veins beneath. The terminal leaflet is often broader than the lateral ones and some of the leaflets (usually the lower pairs) may be deeply parted or divided into two or three segments. Stipules and stipels may be present. The foliage and twigs are ill-scented when bruised.

Flower - The small numerous white fragrant flowers, which open about the middle of July, are perfect, 5-parted, borne in terminal broad flat or slightly rounded long-stalked compound cymes 4 - 7 inches across. At the time the American Elder is in flower, the Red-berried Elder is usually already in fruit.

Fruit - The fruits, which ripen in August or September are round juicy and edible purple-black berry-like drupes, each less than 1/4 inch across, borne in large flat or saucer-shaped clusters.

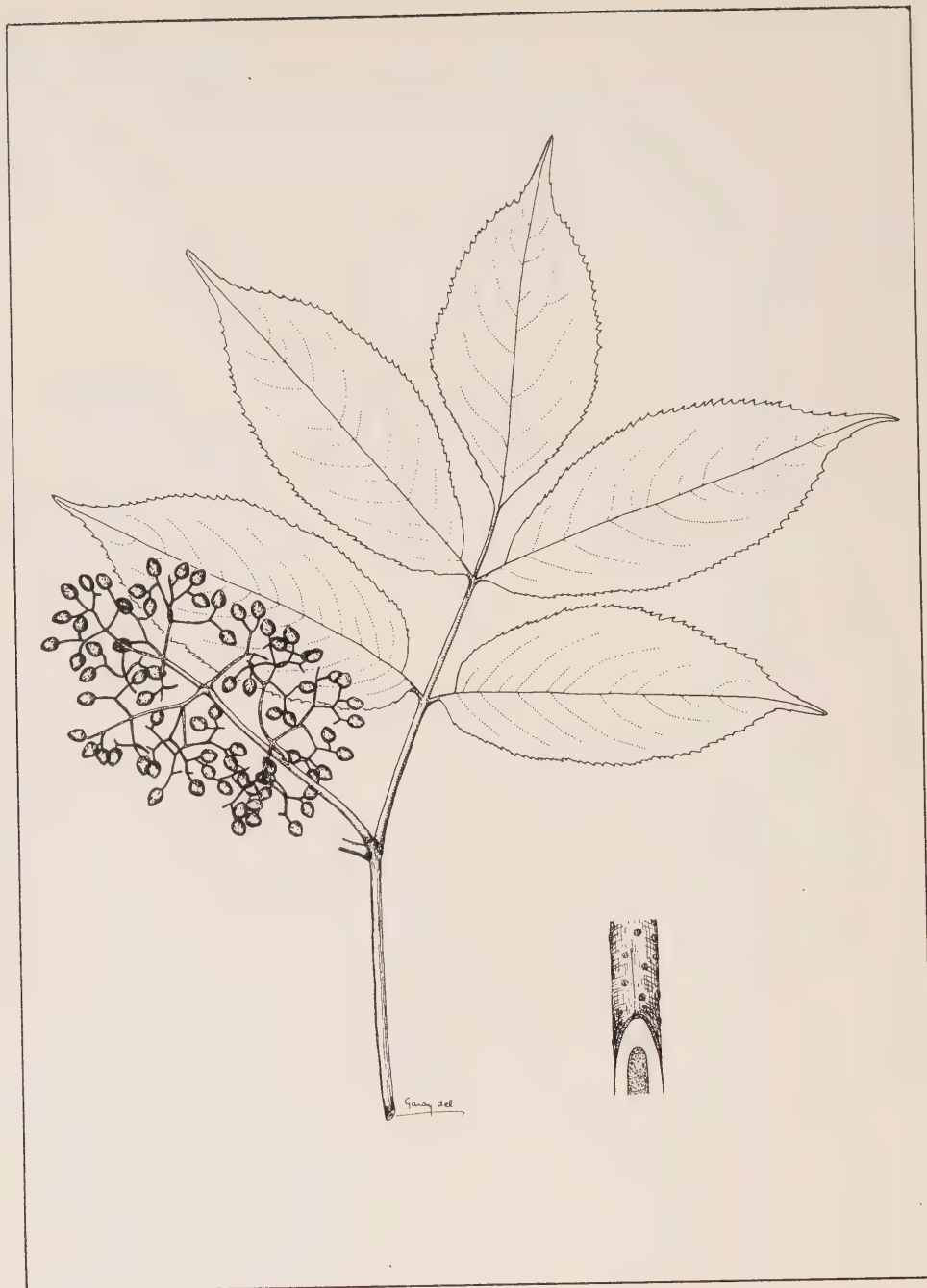
Habitat - In low ground, swamps, thickets, edges of woods, roadsides and fencerows.

Range - Common in southern Ontario and north to the Algoma and Rainy River districts. (Nova Scotia to Manitoba, south to Texas and Georgia.)

Field Check - White pith; large opposite pinnately compound leaves usually with 7 sessile leaflets; fragrant flowers in broad flat or rounded cymes in July; purple-black berries in late summer.

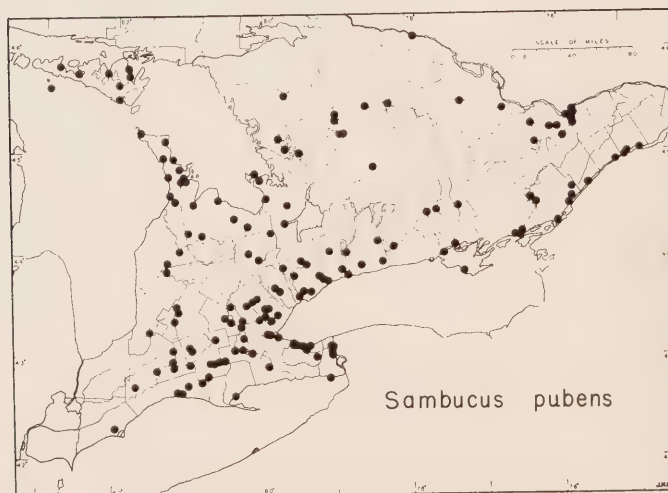






*Sambucus pubens* Michaux

RED-BERRIED ELDER



Habit - The Red-berried Elder is an erect soft-stemmed or barely woody shrub growing to a height of 15 feet or more.

Twig - The young branchlets are yellow-brown and hairy. The twigs are stout with warty gray-brown bark and large orange to reddish-brown pith.

Leaf - The leaves are large, opposite, pinnately compound and deciduous, with a petiole 1 - 2 inches long. The 5 - 7 (usually 5) short to prominently stalked leaflets are ovate-lanceolate, 2 - 5 inches long, 1 - 2-1/4 inches wide, sharply serrate, abruptly and conspicuously sharp-pointed and rounded or somewhat cordate at the usually asymmetrical base, green above, paler and either smooth or downy beneath. Stipules and stipels may be present. The foliage and twigs are ill-scented when bruised.

Flower - The small numerous white ill-scented flowers are perfect, 5-parted, borne in terminal elongate, rounded or pyramidal compound cymes 2 - 5 inches long, usually longer than broad. The flowers open in May or June (from May 15th in southern Ontario to June 30th in northern Ontario) with the developing leaves - about five or six weeks before those of the American Elder.

Fruit - The fruits, which ripen in July or August are round inedible red berry-like drupes, each less than 1/4 inch across, borne in an elongate open cluster.

Habitat - In thickets, ravines, open woods and clearings, or along roadsides, edges of woods and in fence-rows.

Range - Common throughout southern Ontario and north to James Bay and north-western Ontario. (Newfoundland to Alaska, south to Oregon and Vermont.)

Field Check - Brown pith; large opposite pinnately compound leaves usually with 5 stalked leaflets; ill-scented flowers in elongate cymes in May or June with the developing leaves; red berries in midsummer.



## THE VIBURNUMS (Viburnum)

The Viburnums include low, medium and tall shrubs with opposite branches and opposite leaves which are usually toothed. The flowers are small, perfect and five-parted, white or creamy-white, borne in compound cymes. The fruits are firm or juicy blue or red berry-like drupes, each with a single hard flattish stone in the middle.

The leaves of the Withe-rod (Viburnum cassinoides) may be entire or the margin may be irregularly toothed or wavy. In the Hobblebush (V. alnifolium) and the Highbush Cranberry (V. trilobum) there are two kinds of flowers, a series of larger sterile ones with expanded flattened corollas surrounding a central cluster of small fertile ones.

The usually toothed leaves and the five-parted corolla distinguish the Viburnums at once from all the Dogwoods (Cornus) in which the leaves are always entire and the corolla four-parted.

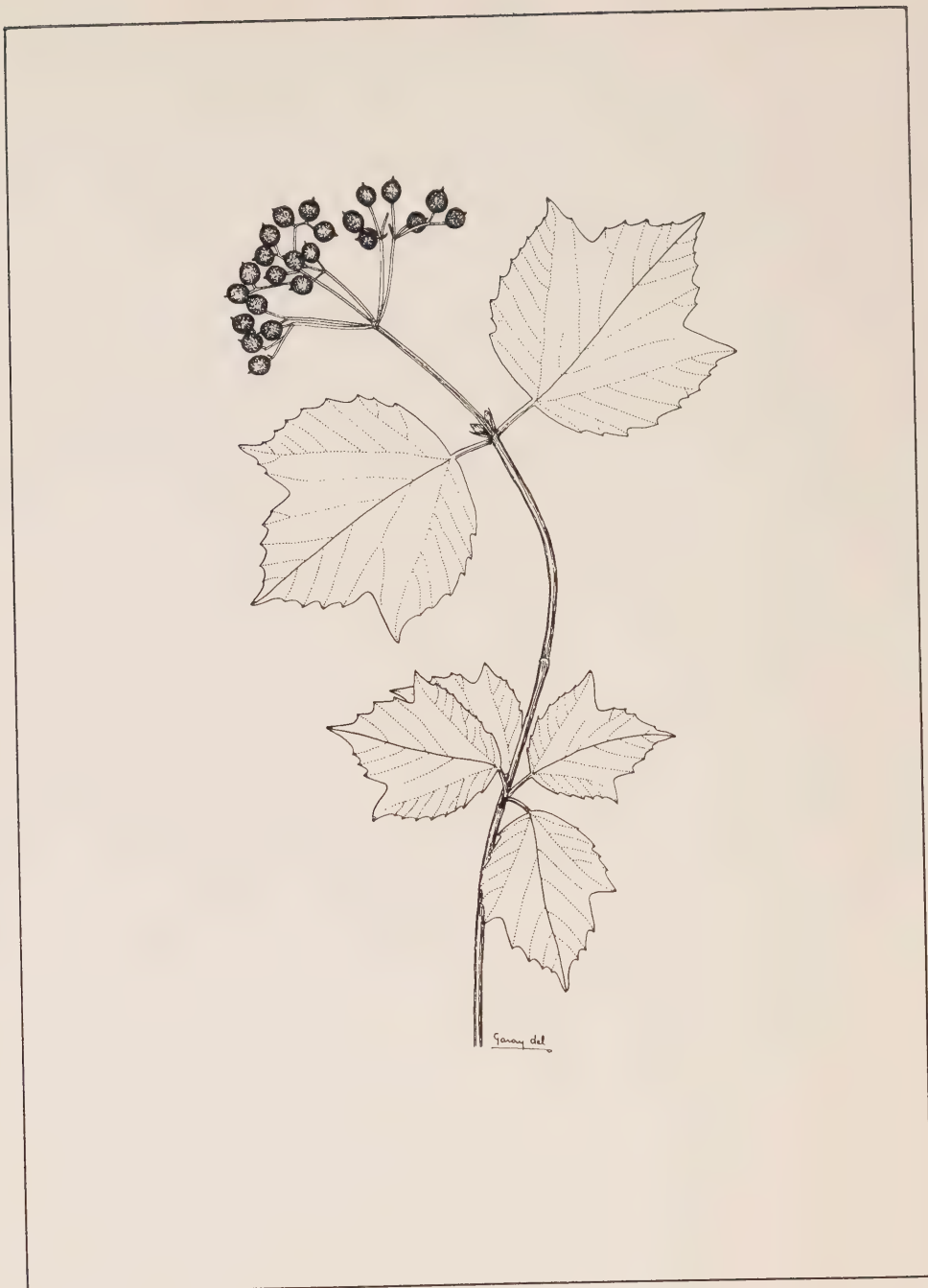
FIELD CHECK - Opposite usually toothed leaves; cymes of five-parted flowers; coloured berry-like fruits each with a single flattish stone.

### Key to Species

- a. Leaves three-lobed, palmately 3-5-nerved from the base . . b.
  - b. Leaves smooth or with scattered single hairs and no resinous dots beneath; fruit orange-red . . . c.
    - c. Stipules none; flowers few, all alike, on two-leaved short branches from lateral buds . . . 1. V. edule
    - c. Stipules slender with thickened tips; flowers numerous, of two kinds, the outer enlarged and showy, on leafy shoots from terminal buds . . . 2. V. trilobum
  - b. Leaves soft-downy beneath with clustered hairs and tiny brown to blackish resinous dots; fruit blue . . . 3. V. acerifolium
- a. Leaves without lobes, pinnately nerved . . . d.
  - d. Sprawling shrubs with large leaves (4-8 inches long); flowers of two kinds, the outer enlarged and showy . . 4. V. alnifolium
  - d. Erect shrubs with small leaves (1-4 inches long); flowers all alike . . . e.
    - e. Leaves entire, finely or irregularly toothed but not coarsely dentate; cymes short-stalked or sessile . . . f.
      - f. Leaves finely and sharply serrate; winter buds golden-brown; cymes sessile . . . 5. V. Lentago
      - f. Leaves entire or irregularly crenulate or wavy-toothed; winter buds gray; cymes short stalked . . . 6. V. cassinoides
    - e. Leaves coarsely toothed; cymes long-stalked . . . g.
      - g. Leaves usually hairy beneath, sessile or short-stalked with bristle-like stipules; teeth 4-11 on each side . . . 7. V. Rafinesquianum
      - g. Leaves smooth or hairy on the veins and in the vein axils beneath, clearly stalked, without evident stipules; teeth 9-21 on each side . 8. V. recognitum

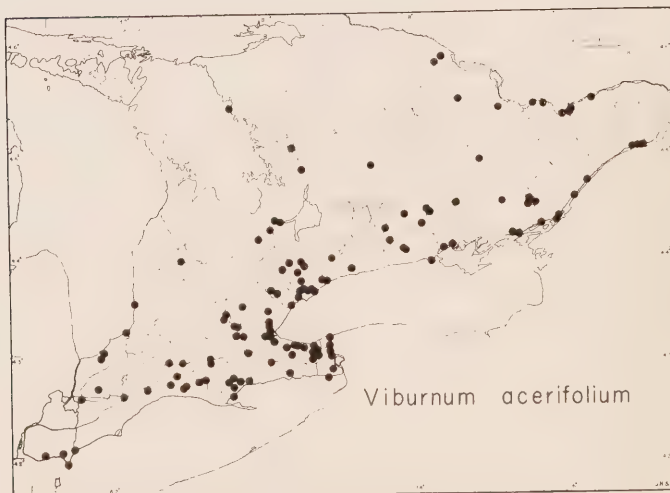






*Viburnum acerifolium* Linnaeus

MAPLE-LEAVED VIBURNUM



Habit - The Maple-leaved Viburnum is a low shrub with slender ascending branches, usually reaching less than 6 feet in height.

Twig - The young branchlets are green and smooth or minutely hairy. The older stems become reddish or purplish-gray.

Leaf - The leaves are opposite, simple and deciduous, three-lobed with two shallow clefts separating the median lobe from the two spreading lateral lobes. The blade varies in shape from nearly round to ovate to ovate-lanceolate, sharp-pointed at the tip, rounded or cordate at the base with the margin coarsely dentate, dark green and sparsely hairy above, paler and softly downy beneath with clustered hairs and numerous minute brown or blackish resinous dots scattered over the lower surface. The petiole is downy,  $1/2$  -  $1-1/4$  inches long with a pair of bristle-tipped stipules at the base. Leaves with poorly developed lateral lobes or completely unlobed may be found at the ends of some branches. In the fall the leaves often turn attractive shades of purple and pink.

Flower - The flowers, which open about the middle of June, are creamy-white, numerous in long-stalked terminal cymes 1 -  $3-1/2$  inches across.

Fruit - The fruits, which ripen in September or October, are round to ovoid drupes, at first red and then turning dark blue to purple-black, borne in open clusters.

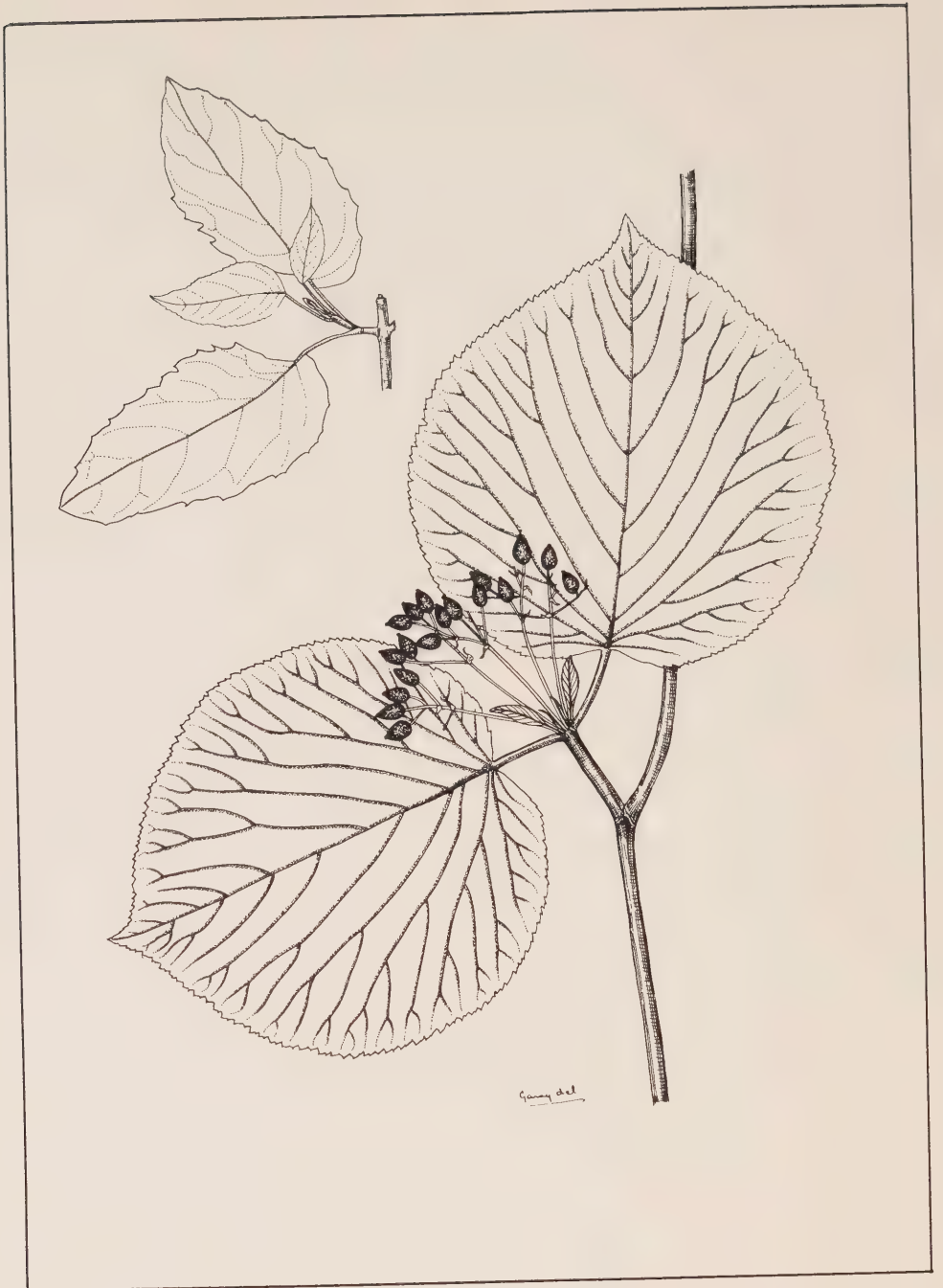
Habitat - In open woods, thickets, ravine slopes or hill-sides in dry or moist sandy, rocky or clay soil.

Range - Common just north of Lake Erie and Lake Ontario, rarer northward and absent in northern Ontario. (South-western Quebec to Minnesota, south to Tennessee and Georgia.)

Field Check - Maple-like leaves downy and minutely resin-dotted beneath; creamy-white flowers in stalked terminal clusters; dark blue to purple-black fruits.

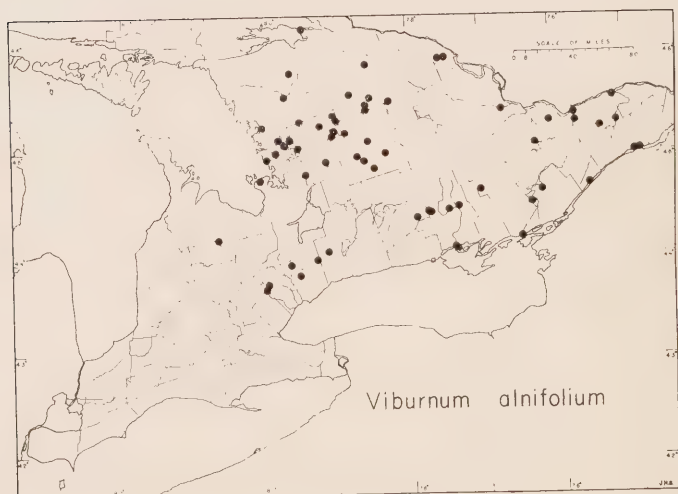






*Viburnum alnifolium* Marshall

HOBBLEBUSH



Habit - The Hobble-bush is a low sprawling and spreading shrub usually less than 6 feet in height with the branches often prostrate and rooting at the nodes and tips.

Twig - The young branchlets are covered with a dense scurfy pubescence which is light cinnamon-brown in colour. The older twigs are purplish-brown and smooth, or sometimes a little ridged and warty. The large naked (without scales) scurfy-covered winter buds are conspicuous from late summer to the following spring.

Leaf - The large coarse simple leaves are opposite and deciduous, broadly oval or almost round, 4 - 8 inches long and 3 - 7 inches wide, closely toothed along the margin, dark-green above, paler beneath, covered when young with a light brown scurfy pubescence which persists on the prominent veins on the lower surface. The tip of the leaf is abruptly pointed and the base is rounded or heart-shaped. The scurfy-hairy petiole, 1/2 - 2-1/2 inches long, has a pair of stipules with free bristle-like tips, these later deciduous. The leaves are borne chiefly in distant pairs along the stem and on its short branches in a horizontal arrangement like a series of steps or platforms. Leaves on sprout-growth (shown at top left) are often thin-textured, narrowly ovate, coarsely toothed and smooth on both surfaces.

Flower - The white flowers are borne in short-stalked showy saucer-shaped clusters up to 5 inches across and open in late May or early June. There are two kinds of flowers, the outer ones sterile with enlarged flattened corollas, surrounding the smaller fertile ones in the middle of the cluster.

Fruit - The fruits, which ripen in August or September, are small ovoid berry-like drupes, each of which is about 3/8 inch long, changing from crimson to purple-black, borne in open clusters.

Habitat - In damp woods, cool shaded ravines and thickets.

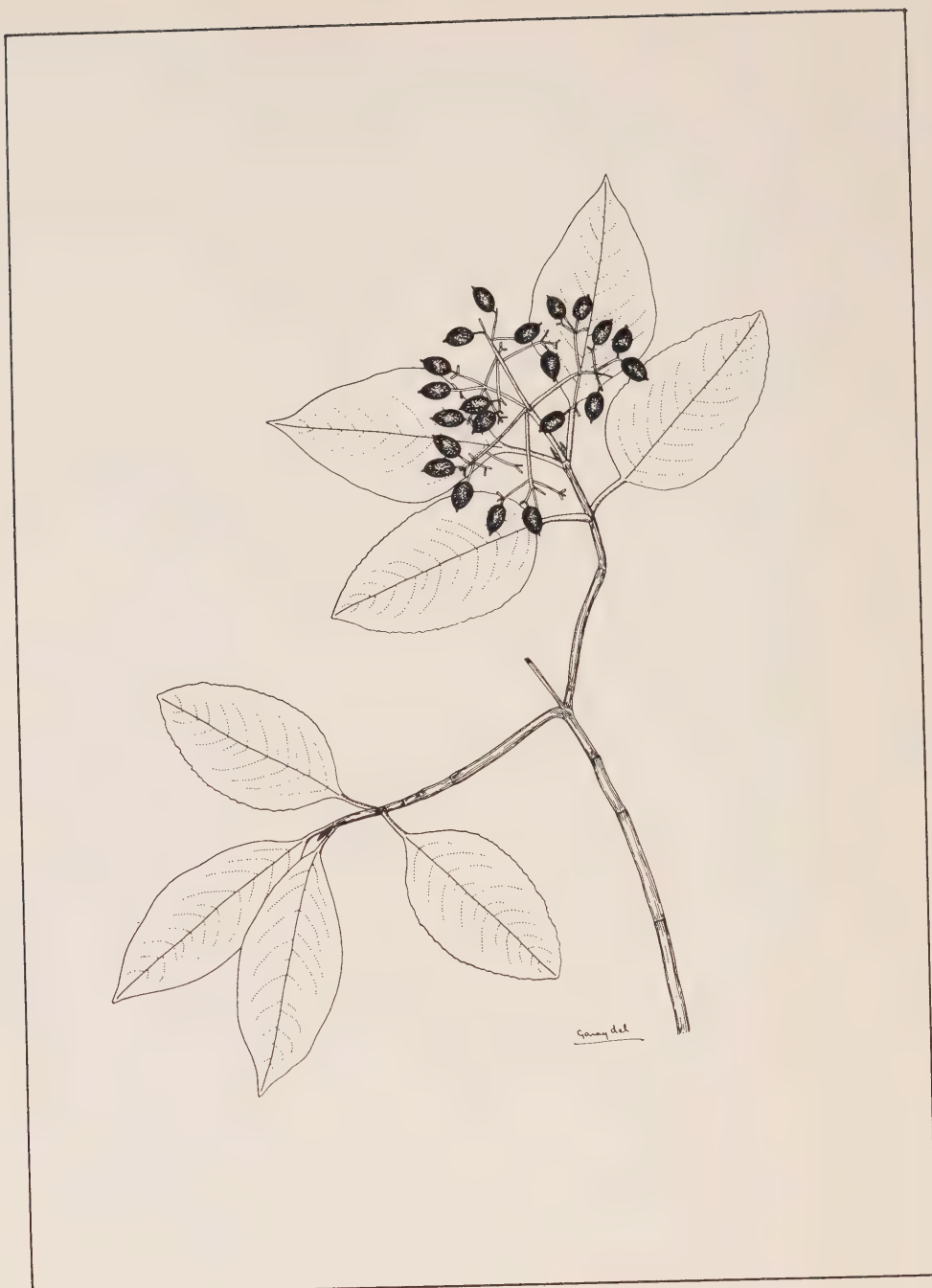
Range - Common on the Canadian Shield in southern Ontario, less common south and east of the Shield; rare or absent in the Carolinian Zone; apparently not north of 47°n. latitude. (Prince Edward Island to southern Ontario, south to Tennessee and Georgia.)

Note - Viburnum Lantana Linnaeus, The EUROPEAN WAYFARING TREE, sometimes planted as an ornamental in southern Ontario and occasionally found as an escape along roadsides and in semi-natural surroundings, has leaves which resemble slightly those of V. alnifolium, but are usually longer than wide. It also differs in having an erect dense habit and flowers of only one kind.

Field Check - Sprawling habit; large round veiny toothed leaves; showy marginal flowers bordering a saucer-shaped cluster; purple-black fruits; large scaleless scurfy winter buds.

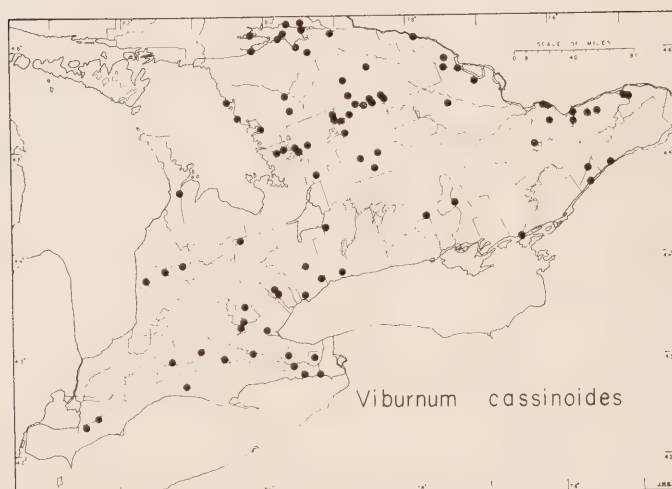






*Viburnum cassinoides* Linnaeus

WITHEROD



Habit - The Withe-rod is an erect, rather stiffly branched shrub up to 15 feet tall, spreading at the top.

Twig - The young branchlets are often scurfy at first, later becoming smooth. The older twigs are purplish, somewhat warty and ridged. The narrow winter buds are covered by a single pair of golden-brown scurfy scales.

Leaf - The leaves are opposite, simple and deciduous. The blade is oval, oblong or oblanceolate to rhombic-ovate, 1-3/4 - 3-3/4 inches long, 1 - 2 inches wide, with an abrupt blunt tip and a narrowed or rounded base, dull dark green above, paler beneath, the margin entire, crenate or wavy-toothed. The main vein is pale above and brown-hairy beneath. The grooved petiole is 1/4 - 3/4 inch long.

Flower - The flowers, which open towards the end of June, are creamy-white, ill-scented, all alike in rather flat terminal short-stalked cymes 2-4 inches across.

Fruit - The fruits, which ripen in August or September, are nearly round or ellipsoid drupes, each 1/4 - 3/8 inch long, borne in open clusters. They are whitish-yellow at first, then quickly turning colour through pink to bright blue to blue-black with a bloom.

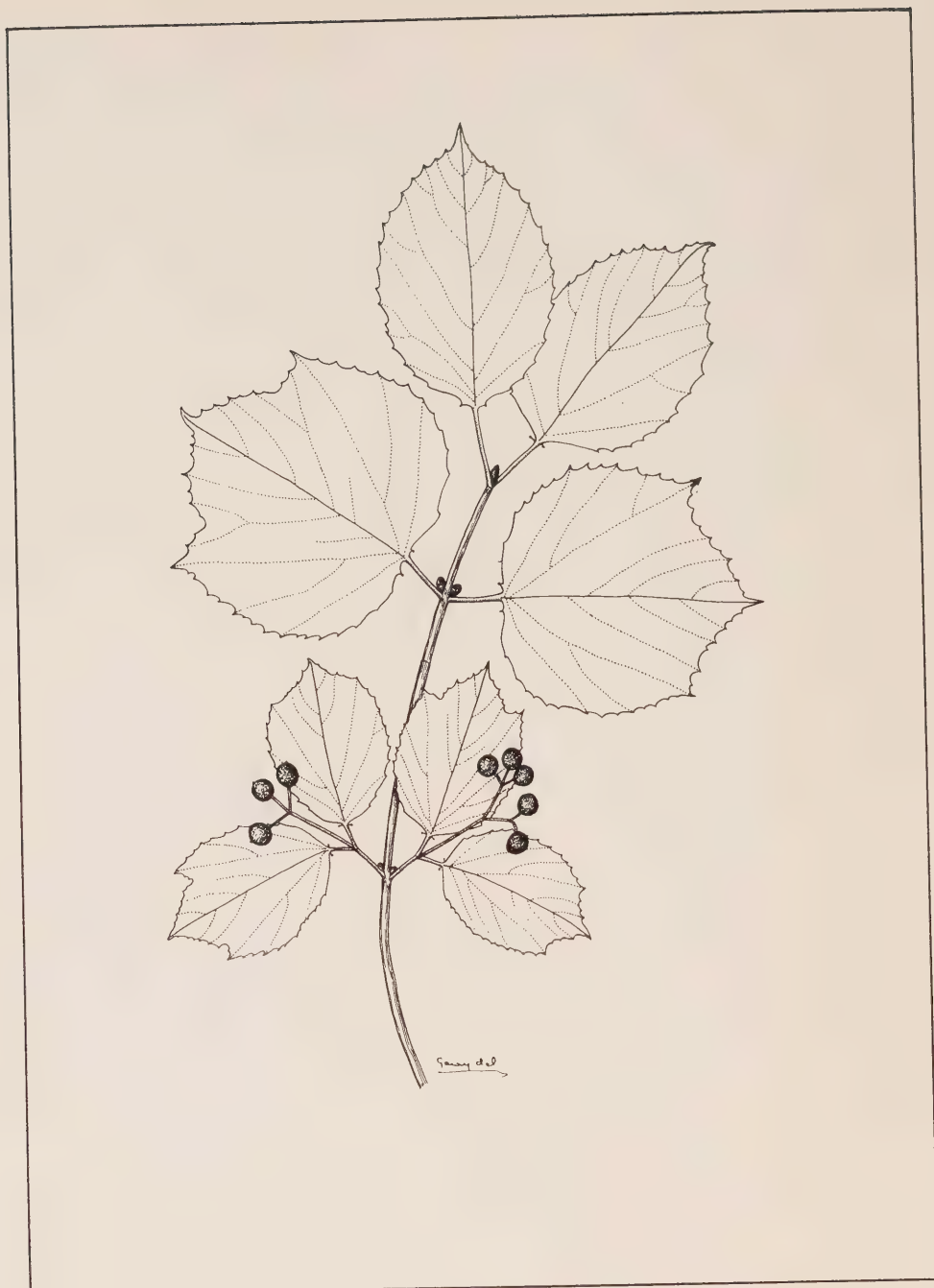
Habitat - In moist or acid soils, damp sandy banks, thickets, low woods, swamps and around the edges of bogs.

Range - Common on the Canadian Shield, less common to the south and east; northward to about 49° n. latitude. (Newfoundland to Ontario, south to Indiana and Alabama.)

Field Check - Entire, crenate or wavy-toothed leaves; short-stalked cymes of ill-scented white flowers; open clusters of blue fruits; narrow golden-brown winter buds.







*Viburnum edule* (Michaux)

SQUASHBERRY

Viburnum edule (Michaux) Rafinesque      SQUASHBERRY, MOOSEBERRY,  
PIMBINA

Habit - The Squashberry is an erect or straggling shrub growing to a height of 6 or 7 feet.

Twig - The young branchlets are smooth, purplish-brown, often angled or with longitudinal ridges. The bark on older twigs is gray to brown.

Leaf - The leaves are opposite, simple and deciduous, usually 3-lobed with two shallow clefts separating the median lobe from the two lateral divergent lobes. The general shape varies from round to ovate to ovate-lanceolate and the leaves at the ends of the main branches often bear poorly developed lobes or are unlobed. The blade is 1-1/2 - 4-1/2 inches long, 1 - 4-1/2 inches wide, sharp-pointed at the tip, rounded, cordate or tapered at the base, toothed along the margin, dark green and smooth above, paler beneath and hairy along the veins and in their axils. The petiole is smooth, 1/4 - 1-1/2 inches long, without stipules but commonly there are several stalked glands along the edge of the leaf near its junction with the petiole.

Flower - The creamy-white flowers which open in June or early July are borne in comparatively few-flowered stalked open clusters about one inch across on short two-leaved branches from lateral buds of the old wood.

Fruit - The fruits are ovoid or round juicy berries, each 1/4 - 1/2 inch long, at first yellow, later turning orange or red and ripening in July or August.

Habitat - In damp woods, swampy clearings, bogs and along lakeshores and stream-banks.

Range - Michipicoten and the north shore of Lake Superior to James Bay; not recorded in southern Ontario nor south of 47° n. latitude in central Ontario. (Labrador to Alaska, south to Oregon and New England.)

Field Check - Three-lobed leaves hairy on veins beneath; few white flowers and orange-red fruits on two-leaved side branches from the old wood.

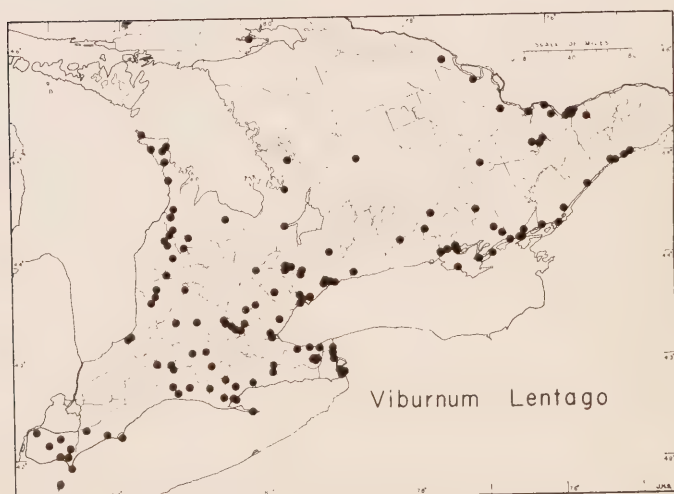






*Viburnum Lentago* Linnaeus

NANNYBERRY



Habit - The Nannyberry is a large shrub, sometimes tree-like, with a spreading top, growing to a height of 20 feet or more, occasionally thicket-forming.

Twig - The twigs are slender, brownish and slightly scurfy, later becoming purplish-brown to grayish and smooth or a little ridged. The winter buds are gray, long and narrow, the terminal flower buds swollen at the base.

Leaf - The leaves are opposite, simple and deciduous. The blade is elliptic-lanceolate to ovate, 2 - 4 inches long, 1 - 2-3/4 inches wide, tapered or abruptly pointed with a prolonged tip, rounded or tapered at the base, dark green above, a little paler beneath and generally smooth on both surfaces or a little scurfy on the veins beneath. The margins are finely and sharply serrate with incurved pale, often gland-tipped, teeth. There is a grooved petiole 1/4 - 1 inch long with wavy wing-like margins.

Flower - The flowers, which open in late May or early June, are creamy-white, sweet-scented, all alike in terminal sessile cymes 2-4 inches across.

Fruit - The fruits, which ripen in August or September, are nearly round to ellipsoid drupes up to 1/2 inch long, blue-black with a bloom, borne in open clusters. The pulp around the large stone is sweet and edible.

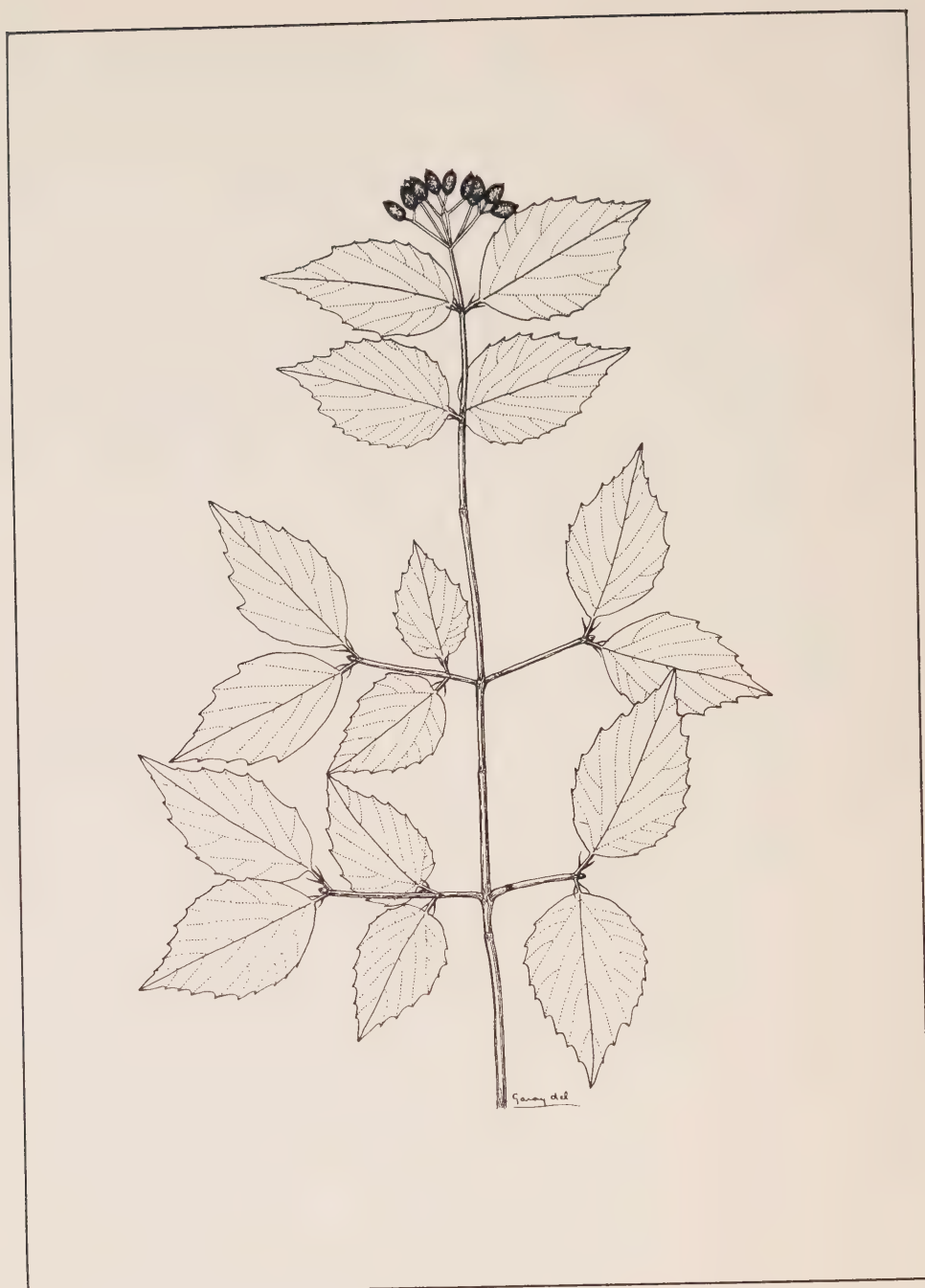
Habitat - In swamps, marshes, along shores and edges of low woods and thickets.

Range - Common in southern Ontario especially in the limestone areas west, south and east of the Canadian Shield; less common northward to about 47° n. latitude; Rainy River District. (Western Quebec to Manitoba, south to Colorado and Georgia.)

Field Check - Finely toothed leaves with grooved and wavy-margined winged petioles; sweet scented white flowers in sessile cymes; open clusters of blue fruits; elongate pointed gray winter buds, the terminal ones (flower buds) swollen at the base.

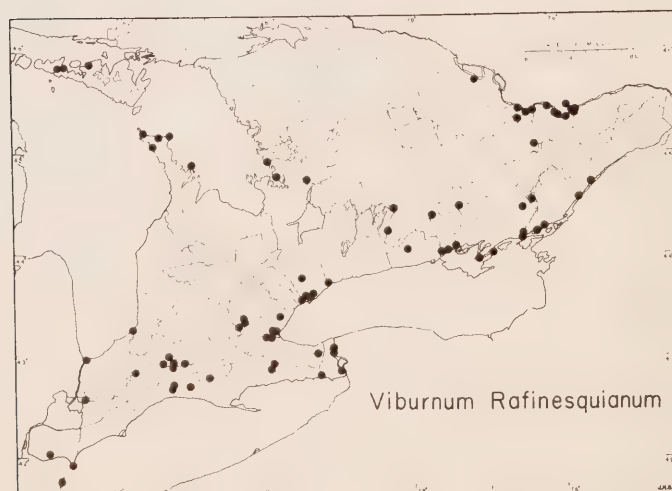






*Viburnum Rafinesquianum* Schultes

DOWNY ARROW-WOOD



Habit - The Downy Arrow-wood is a small erect or spreading shrub usually less than 5 feet high.

Twig - The young branchlets are yellowish-brown, smooth or a little downy. The older twigs are smooth, purplish to brownish-gray.

Leaf - The leaves are opposite, simple and deciduous. The blade is ovate to oblong-lanceolate, 1-1/2 - 3-1/2 inches long, 5/4 - 2-1/4 inches wide, acute or long tapering at the tip, rounded or heart-shaped at the base, smooth and dark green above, paler and smooth or downy at least on the prominent veins beneath. The margin of the leaf is coarsely dentate with 4 - 11 teeth on each side. The grooved petiole is very short, rarely up to 3/8 inch long, with a pair of bristle-like stipules at the base usually longer than the petiole.

Flower - The flowers, which open in late May or early June, are creamy-white, borne in terminal stalked cymes 2 - 3 inches across.

Fruit - The fruits, which ripen in August or September, are ellipsoid dark purple to black drupes, each 1/4 - 3/8 inch long, borne in open clusters.

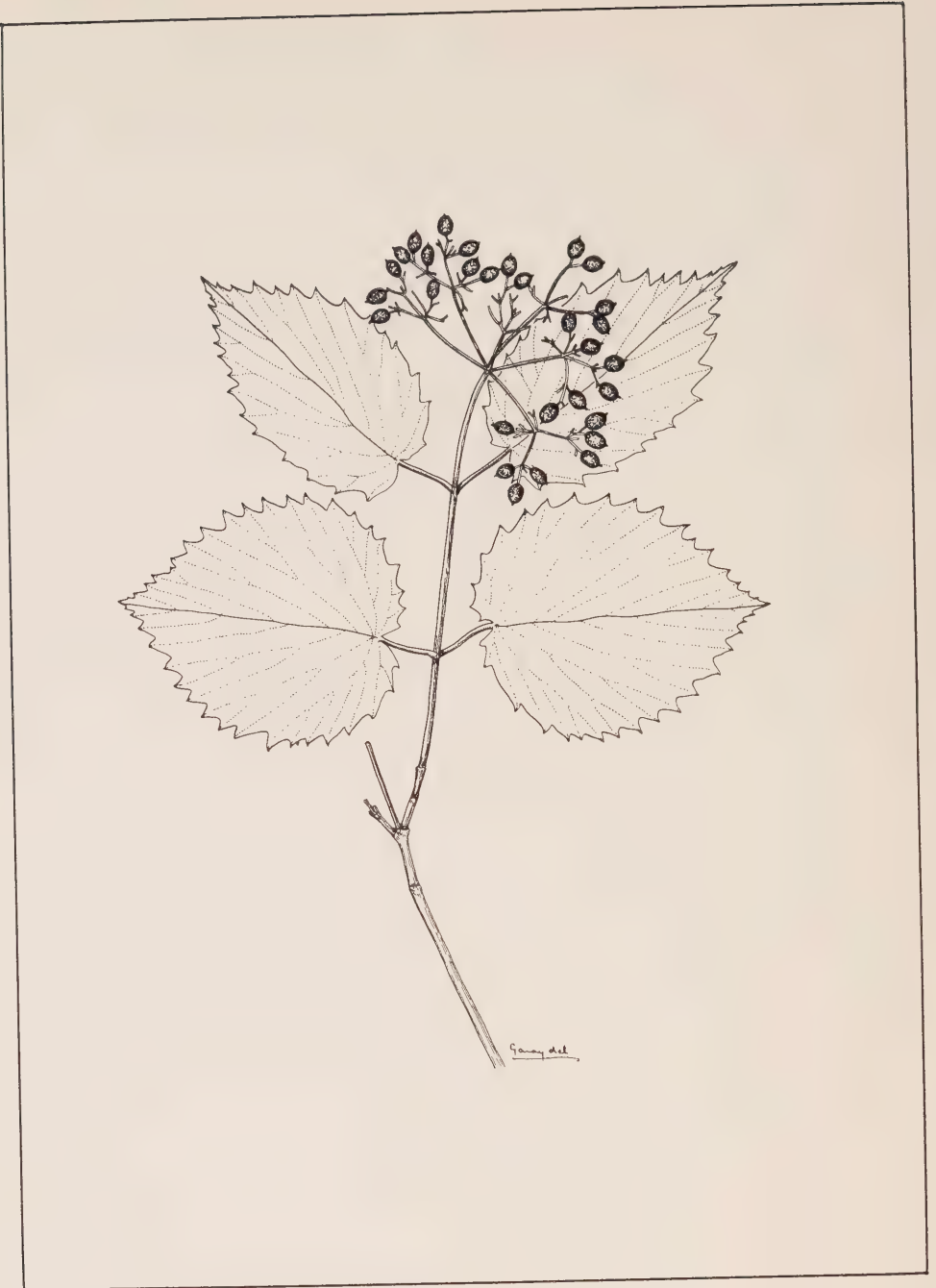
Habitat - In dry thickets, open woods, hillsides and riverbanks or on calcareous slopes and ledges.

Range - In southern Ontario chiefly south and east of the Canadian Shield, north to Georgian Bay, Manitoulin and Thunder Bay districts. (Southwestern Quebec to Manitoba, south to Arkansas and Georgia.)

FIELD CHECK - Low shrub of dry places; coarsely toothed, most stipulate, sessile or short-stalked leaves; open clusters of purple-black fruits.

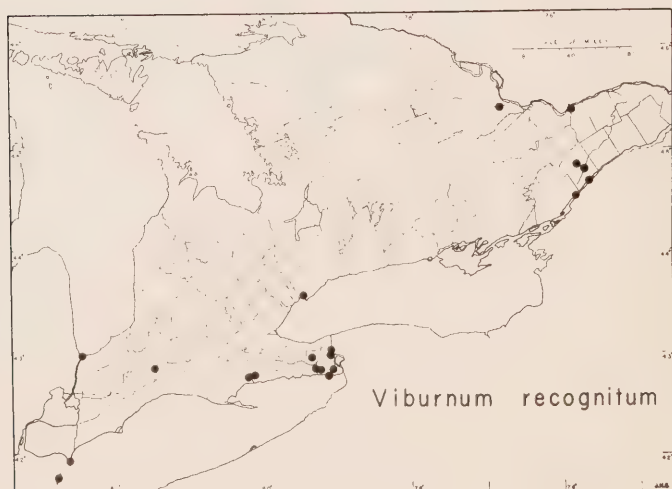






*Viburnum recognitum* Fernald

SOUTHERN ARROW-WOOD



Habit - The Southern Arrow-wood is an upright or slightly spreading shrub growing to a height of 10 feet or more.

Twig - The twigs are smooth, brownish at first, later becoming purplish-gray, bluntly angled and with scattered corky warts.

Leaf - The leaves are opposite, simple and deciduous. The blade is ovate, broadly oval or nearly round,  $1\frac{1}{2}$  - 4 inches long,  $1\frac{1}{4}$  - 3 inches wide, acute or long-tapering at the tip, rounded or heart-shaped at the base, smooth and bright green above, paler and smooth or hairy beneath, especially along the prominent veins and in their axils where the hairs are tufted. The margin is coarsely dentate with 9 - 21 teeth on each side. The grooved petiole is  $\frac{3}{8}$  -  $1\frac{1}{4}$  inches long and stipules are usually lacking.

Flower - The flowers, which open about the middle of June or a little later, are creamy-white ill scented, borne in stout-stalked terminal cymes 2 -  $3\frac{1}{2}$  inches across.

Fruit - The fruits, which ripen in August or September, are round to ovoid dark blue or blue-black drupes each  $\frac{1}{4}$  -  $\frac{3}{8}$  inch long, borne in open clusters.

Habitat - Usually in low wet situations, swampy woods and thickets.

Range - In southern Ontario occasional in the Carolinian Zone and in the watersheds of the Ottawa and St. Lawrence Rivers. (New Brunswick to Michigan, south to Ohio and South Carolina.)

FIELD CHECK - Tall shrub of wet places; coarsely toothed stalked leaves lacking stipules; open clusters of blue-black fruits.

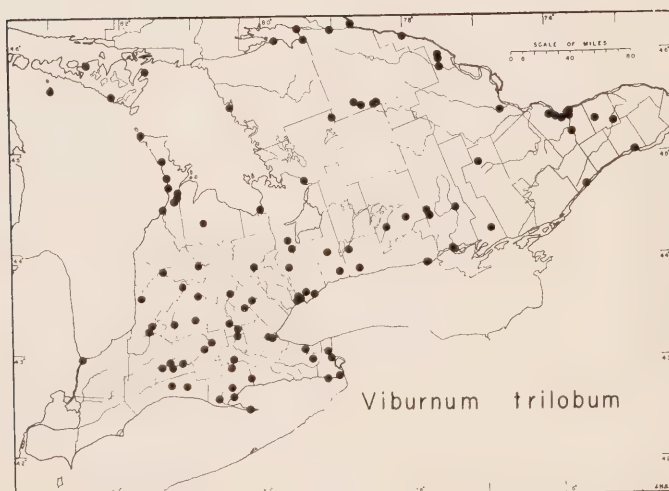






*Viburnum trilobum* Marshall

HIGHBUSH-CRANBERRY



Habit - The Highbush Cranberry is an upright coarse shrub growing to a height of 10 or 15 feet.

Twig - The twigs are smooth, gray to brownish-gray.

Leaf - The leaves are opposite, simple and deciduous, sharply three-lobed with two deep clefts separating the median lobe from the two spreading lateral lobes. The blade is broadly wedge-shaped, 2 - 4-1/2 inches long and about as wide, sharp-pointed at the tip, tapered, rounded or a little heart-shaped at the base, entire or toothed along the margin, dark green and smooth above, paler and smooth or thinly hairy below. The petiole is 1/2 - 1-1/2 inches long, conspicuously grooved with a pair of slender thick-tipped stipules at the base and several small club-shaped glands near the junction with the blade. Leaves with poorly developed lateral lobes or completely unlobed may be found at the ends of some branches.

Flower - The flowers, which open in June or July, are white, borne in showy flat-topped stalked terminal cymes up to 6 inches across. The outer flowers are larger (with expanded flat corollas) and sterile, those in the centre are small and fertile.

Fruit - The fruits, which ripen in August or September, are round or ellipsoid, orange to red, juicy berry-like drupes, borne in open clusters.

Habitat - In damp soil around swamps, bogs, along streams and in low or cool open woods and thickets.

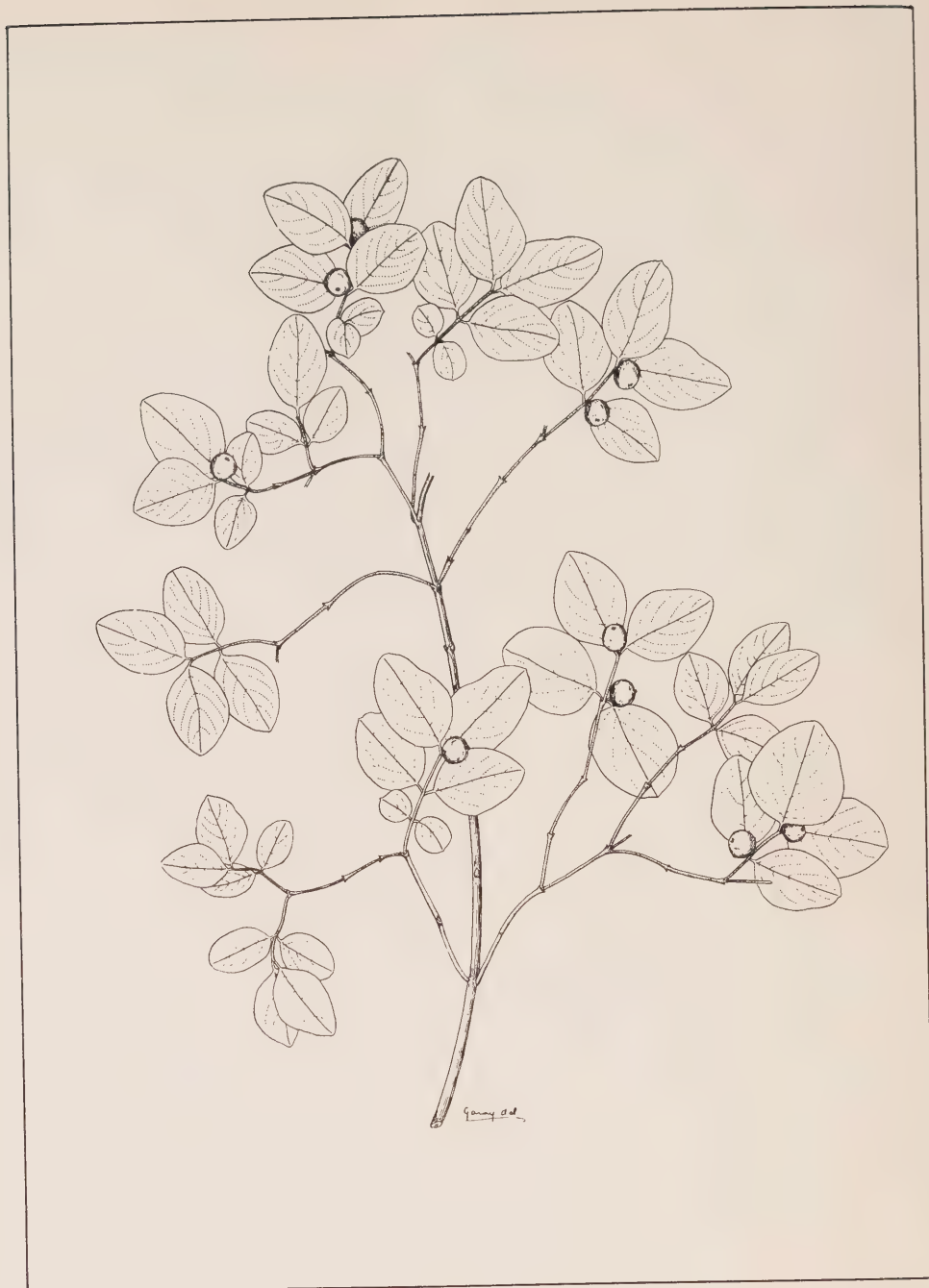
Range - Common in southern Ontario, north to James Bay and northwestern Ontario. (Newfoundland to British Columbia, south to Washington and New England.)

NOTE - Viburnum Opulus Linnaeus, the EUROPEAN Highbush CRANBERRY, often planted as an ornamental in southern Ontario and occasionally found as an escape along roadsides and in woods, resembles V. trilobum closely but differs in having bristle-tipped stipules and the glands at the junction of the petiole and blade are concave with saucer-like disks.

FIELD CHECK - Tall shrub of moist places; three-lobed leaves; showy marginal flowers around a flat cluster; open clusters of orange-red berry-like fruits.

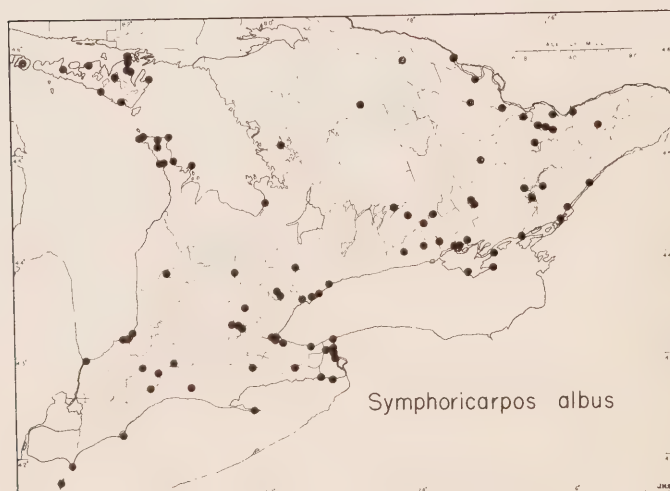






*Symphoricarpos albus* (Linnaeus) Blake

SNOWBERRY



Habit - The Snowberry is a small ascending or spreading shrub usually less than 3 feet high, often forming low thick-ets.

Twig - The twigs are slender, smooth or minutely hairy, light brown at first, turning purplish to gray and darker in age. The bark soon becomes shreddy or fibrous and the small brown pith has a hollow central core.

Leaf - The rather thin leaves are opposite, simple and deciduous, nearly sessile with a petiole less than 1/4 inch long. The blade is elliptic-oblong or rhombic-ovate to nearly orbicular, 1/2 - 2 inches long and 3/8 - 1-1/4 inches wide, blunt or rounded and sometimes minutely pointed at the tip, rounded or tapered at the base, dark green and smooth or with a few appressed hairs above, paler and smooth to minutely downy or whitened beneath, the margin entire and minutely hairy. The leaves on young shoots are usually larger and often wavy-toothed or lobed.

Flower - The small pink and white flowers which open in June or July are perfect, five-parted, tubular or narrowly bell-shaped with short lobes, hairy on the inside and about 1/4 inch long with the stamens and style included. They are borne in short clusters of 1-5 at the ends of the branches and in the axils of the upper leaves.

Fruit - The fruit is a round snow-white spongy berry 1/4 - 1/2 inch across with a dark-end-spot, borne singly or a few together, ripening in August or September.

Habitat - In sandy or rocky open ground, in thickets or on well-drained talus-slopes and ridges.

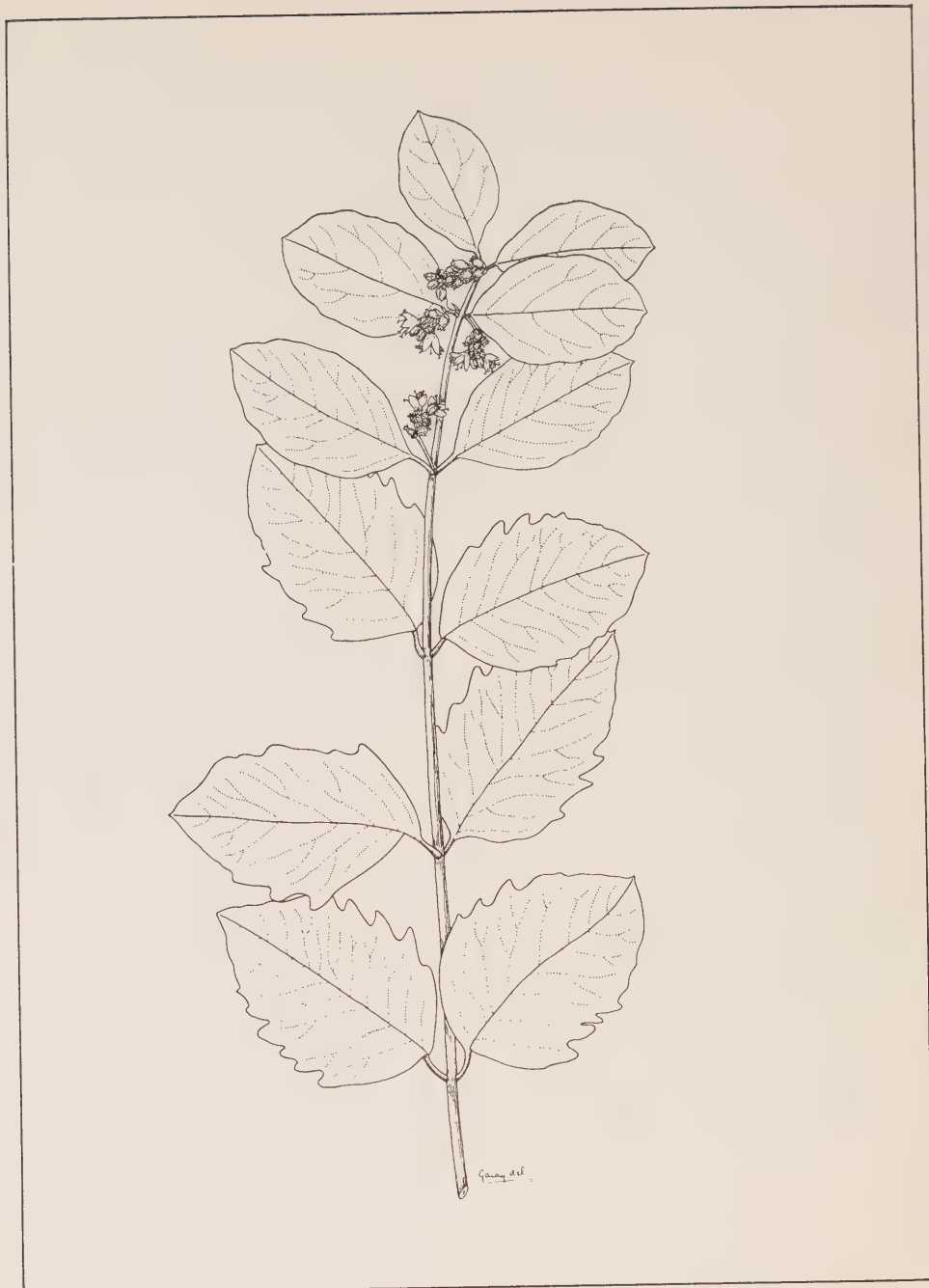
Range - Common in southern Ontario and north at least to the latitude of James Bay. (Quebec to British Columbia, south to Colorado and Virginia.)

NOTE - There is a variety of this species, often cultivated and sometimes escaping to roadsides and waste places, which is taller (up to 6 feet) and coarser with smooth leaves more frequently lobed or wavy-toothed, more numerous flowers in elongate mostly terminal clusters and larger (up to 3/4 inch across) fruits.

FIELD CHECK - Hollow pith; small pink flowers in few-flowered clusters; snow-white berries with dark-end-spot.

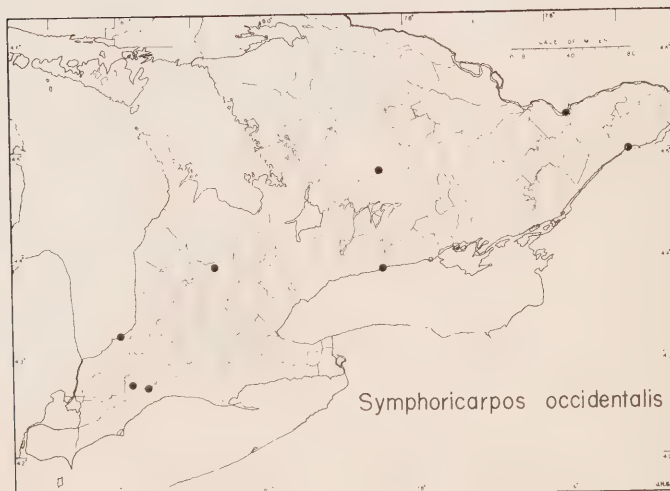






*Symphoricarpos occidentalis* Hooker

WOLFBERRY



Habit - The Wolfberry is a small stiffly erect freely branching shrub up to 3 feet in height, spreading by stolons and commonly forming dense low thickets.

Twig - The slender reddish-brown minutely hairy twigs turn gray with age and the bark soon becomes shredded. The pith is small and brown with a hollow central core.

Leaf - The firm or thick leaves are opposite, simple and deciduous, nearly sessile or with a petiole less than  $\frac{3}{8}$  inch long. The blade is elliptic to oval,  $\frac{3}{4}$  - 3 inches long,  $\frac{1}{2}$  to 2- $\frac{1}{4}$  inches wide, blunt or rounded and frequently minutely pointed at the tip, rounded or tapered at the base, smooth and dark green above, paler and smooth or hairy along the veins beneath. The margin is entire wavy-toothed or lobed, minutely hairy and somewhat revolute.

Flower - The small pale pink flowers are perfect, five-parted, bell-shaped with spreading lobes, densely hairy on the inside, about  $\frac{3}{8}$  inch long with the stamens and style exserted. They are borne in crowded elongate clusters of 2-10 from the ends of the branches and in the axils of the leaves, opening in July or August, about a month later than those of the Snow-berry.

Fruit - The fruit is a round dull-white or greenish-white spongy berry  $\frac{1}{4}$  -  $\frac{1}{2}$  inch across, soon becoming discoloured and blackish. They are rather numerous in crowded clusters.

Habitat - In sandy or rocky soil, dry open fields and along railway embankments (chiefly in disturbed ground.)

Range - Apparently introduced from the west and locally established in the counties of Carleton, Durham, Elgin, Haldiburton, Lambton, Lincoln, Middlesex, Stormont, and Wellington in southern Ontario; also in Kenora, Thunder Bay and Temiskaming Districts in northern Ontario. (Manitoba to British Columbia, south to New Mexico and Michigan; naturalized eastwards to New England and Pennsylvania.)

FIELD CHECK - Hollow pith; small pink flowers in crowded clusters; dull white berries soon turning blackish.



## THE HONEYSUCKLES (Lonicera)

The Honeysuckles are small to medium-sized shrubs or twining climbers with opposite branches and sessile or short-stalked opposite entire simple leaves. The flowers are usually yellowish, tubular to funnel-shaped, perfect and five-parted, borne in pairs from the leaf axils or in terminal whorled clusters. The fruits are orange-red, purplish or blue several-seeded berries, often borne in close pairs, partly or wholly fused together.

The Glaucous Honeysuckle (Lonicera dioica) and the Hairy Honeysuckle (L. hirsuta) are distinguished from the other species by their more vine-like habit of growth and by the fusion of one or more of the upper pairs of leaves across the stem forming saucer-like disks. The very floriferous Tartarian Honeysuckle (L. tatarica), an introduced ornamental, can be recognized by its hollow pith and deeply lobed pink or white flowers.

FIELD CHECK - Opposite entire simple leaves; usually yellowish five-parted tubular flowers; coloured several-seeded berries.

### Key to Species

- a. Plants erect and shrub-like; leaves all distinct; flowers in axillary pairs . . . b.
- b. Pith of branches white, solid; flowers yellowish . . . c.
- c. Bark gray-brown, shredding; flowers and fruits on long (more than 1/2 inch) stalks: fruits red or purplish . . . d.
- d. Leaves acuminate; bracts of the flower-stalks broad and leaf-like, the inner ones enclosing the fruit . . . 1. L. involucrata
- d. Leaves blunt or rounded; bracts of the flower-stalks none or small and inconspicuous . . . e.
- e. Leaves smooth, the margins and short perioles ciliate; berries ovoid, distinct and widely divergent . . . 2. L. canadensis
- e. Leaves short-hairy below, the margins not ciliate; berries round, partly or nearly united, not divergent . . . 3. L. oblongifolia
- c. Bark reddish-brown, peeling in conspicuous papery layers; flowers and fruits on short (less than 1/2 inch) stalks; fruits blue . . . 4. L. villosa
- b. Pith of branches brown with a central cavity; flowers pink or white . . . 5. L. tatarica
- a. Plants trailing, straggling, or ascending, vine-like; leaves distinct below, the upper one to four pairs united across the stem to form disks; flowers in terminal whorled clusters or interrupted spikes from the terminal disks. . . f.
- f. Leaves smooth above, whitened or bluish-white and smooth or hairy beneath, margins not ciliate . 6. L. dioica
- f. Leaves hairy on both surfaces, pale green beneath, margins ciliate . . . 7. L. hirsuta

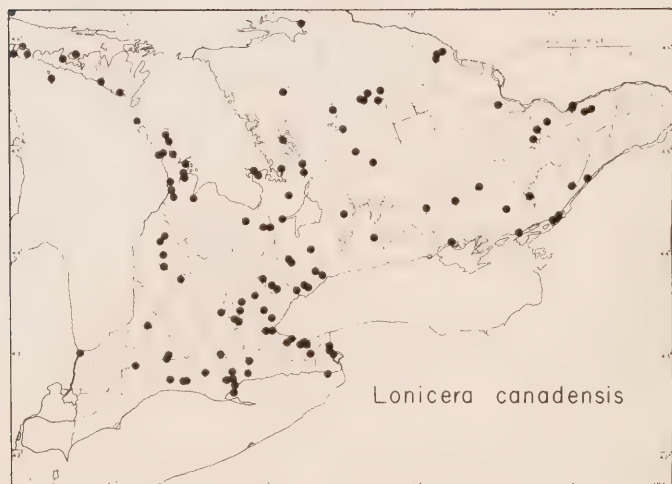






*Lonicera canadensis* BARTRAM

FLY-HONEYSUCKLE



Habit - An erect and loosely branched or straggling shrub up to 4 feet in height usually found as separate plants and rarely, if ever, forming thickets.

Twig - The young branchlets are green or purplish and smooth, later becoming gray to brownish. The bark on the older twigs becomes shreddy with fine thread-like portions coming loose.

Leaf - The thin, opposite, simple and deciduous leaves are ovate-oblong to elliptic, 2 - 3-3/4 inches long and 1 - 2 inches wide, acute or blunt at the tip, rounded, shallowly heart-shaped or tapered at the base, bright green and smooth above, a little paler beneath. The margins of the leaf and the short (less than 3/8 inch long) petiole are ciliate (fringed with short fine hairs.)

Flower - The flowers are pale yellow, tubular to funnel-shaped, 1/2 - 3/4 inch long with short flaring lobes, borne in pairs on long slender stalks from the axils of the leaves. They open in May or June as the leaves are still expanding.

Fruit - The fruit is a long-stalked divergent pair of 3 - or 4- seeded ovoid red berries which ripen in late June or in July.

Habitat - Usually in damp or shaded ground in woods, thickets, ravines or around swamps and bogs.

Range - Common in southern Ontario and north at least to 50° n. latitude. (Quebec to Saskatchewan, south to Iowa and North Carolina.)

FIELD CHECK - Ciliate leaf margins and petioles; pairs of yellow flowers on long slender stalks; twin elongate divergent red berries.

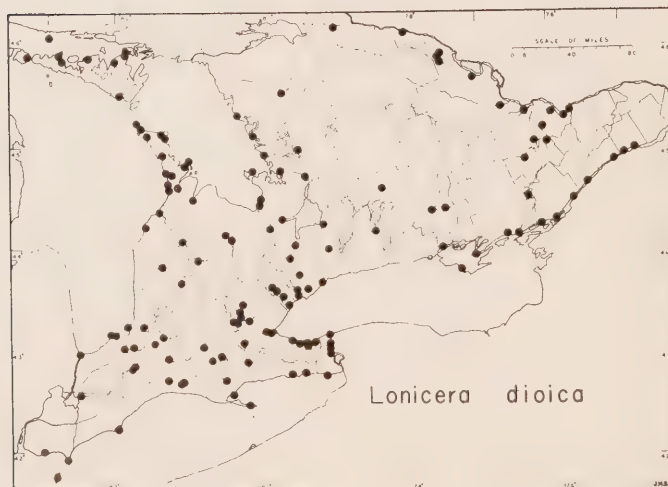






*Lonicera dioica* Linnaeus

GLAUCOUS HONEYSUCKLE



Habit - The Glaucous Honeysuckle is a twining woody vine or semi-erect shrub growing to a length of 10 feet or more.

Twig - The branchlets are smooth and green or purplish, the older stems turning brown to gray, the bark peeling and shredding.

Leaf - The leaves are opposite, simple and deciduous, sessile or the lower ones distinctly stalked with a petiole up to 1/2 inch long, the upper one to four pairs usually joined across the stem to form saucer-like disks. The blade of the lower leaves varies in shape from narrowly elliptical to oblong to broadly oval, 1-1/2 - 4-1/2 inches long, 1/2 - 2-1/2 inches wide, rounded or blunt at the tip, dark green and smooth above, strongly whitened to bluish-white and smooth or hairy beneath, the margin entire.

Flower - The flowers, which open in late May, in June, or in early July, are tubular to funnel-shaped, 1/2 - 3/4 inch long, with two spreading lips. They are borne in stalked clusters from the centre of the terminal leafy disks and the colour varies from greenish-yellow to orange to purplish-red.

Fruit - The fruits, which ripen in July or August, are orange-red berries, borne in terminal clusters subtended by the leafy disks.

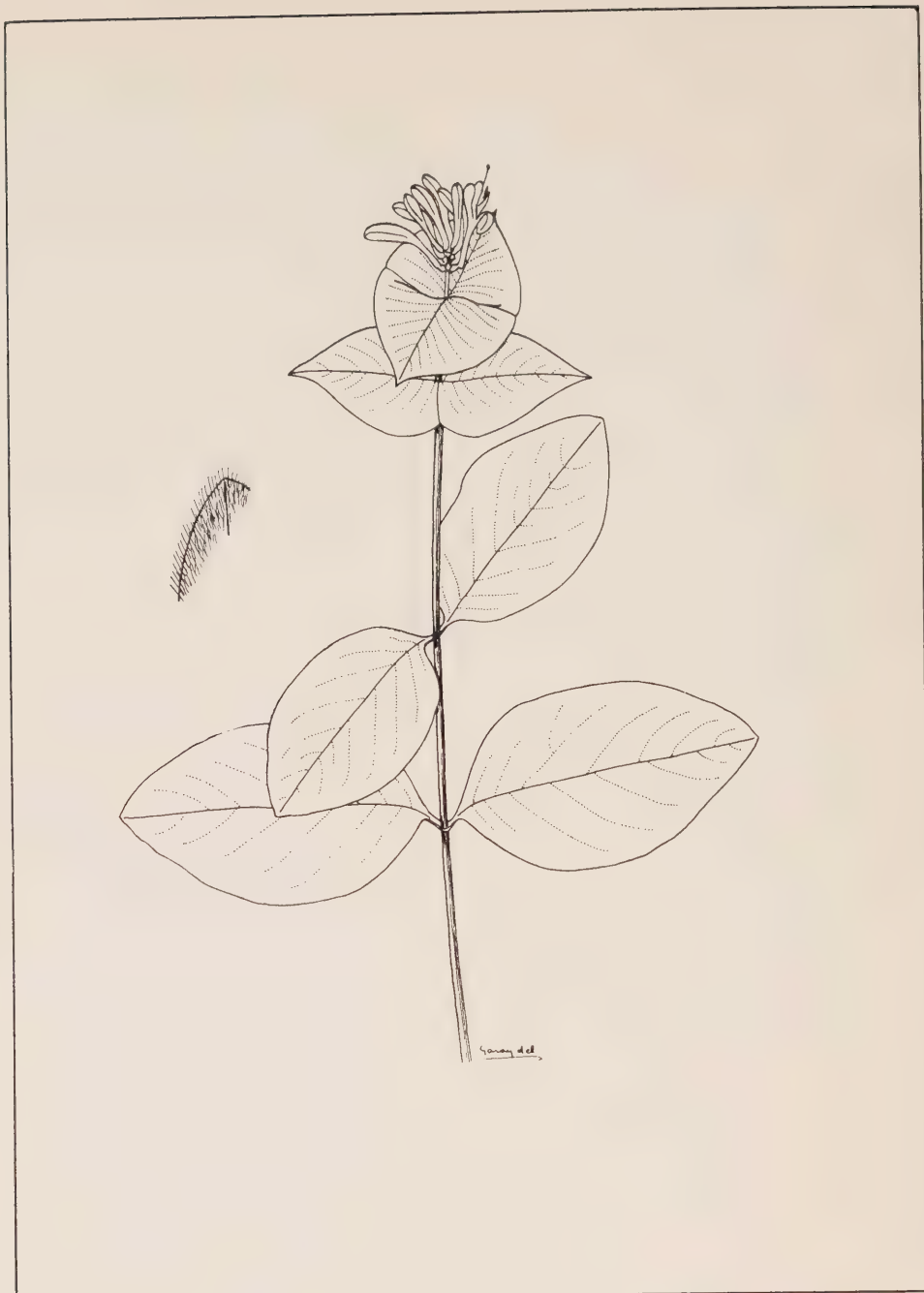
Habitat - In dry or moist situations, open woods, thickets, rocky ridges, slopes, shores and fencerows.

Range - Common in southern Ontario, especially in the Calcareous areas west, south and east of the Canadian Shield, northward to James Bay and north-western Ontario. (Maine to British Columbia, south to Missouri and Georgia).

FIELD CHECK - Straggling shrub or twining climber; leaves whitened beneath, the 1-4 upper pairs joined across the stem; orange-red berries in terminal clusters subtended by leafy disks.







*Lonicera hirsuta* EATON

HAIRY HONEYSUCKLE



Habit - The Hairy Honeysuckle is a trailing or high-climbing woody vine growing to a height of 10 feet or more.

Twig - The young branchlets are green or purplish, glandular-hairy, often spotted with purplish-brown. The older twigs are brown to gray with conspicuous shredding bark.

Leaf - The leaves are opposite, simple and deciduous, sessile or with a petiole up to 1/2 inch long, the upper one or two pairs joined across the stem to form saucer-like disks usually with two pointed tips. The blade of the lower leaves is ovate, oval or broadly elliptic, 2 - 5 inches long, 1 - 3 1/2 inches wide, rounded or blunt at the tip and rounded or tapered at the base, dull green above with appressed silky hairs, green beneath with a velvety covering of silky hairs. The margins are ciliate with a fringe of silky hairs which shine in transmitted light. This latter character serves to distinguish the Hairy Honeysuckle at once from the Glaucous Honeysuckle which has the same twining habit but not the ciliate leaf-margins.

Flower - The flowers, which open late in June, in July or in early August, are narrowly tubular, 3/4 - 1 inch long, with gradually flaring lobes. They are yellow to orange in colour and borne in a single stalked cluster or in several whorls forming interrupted spikes from the centre of the terminal leafy disks.

Fruit - The fruits, which ripen in August or later, are orange-red several-seeded berries, borne in a single terminal cluster or in several separate clusters subtended by leafy disks.

Habitat - In dry or moist situations, sandy, gravelly or rocky woods, thickets, slopes and clearings; also in swampy or mossy woods.

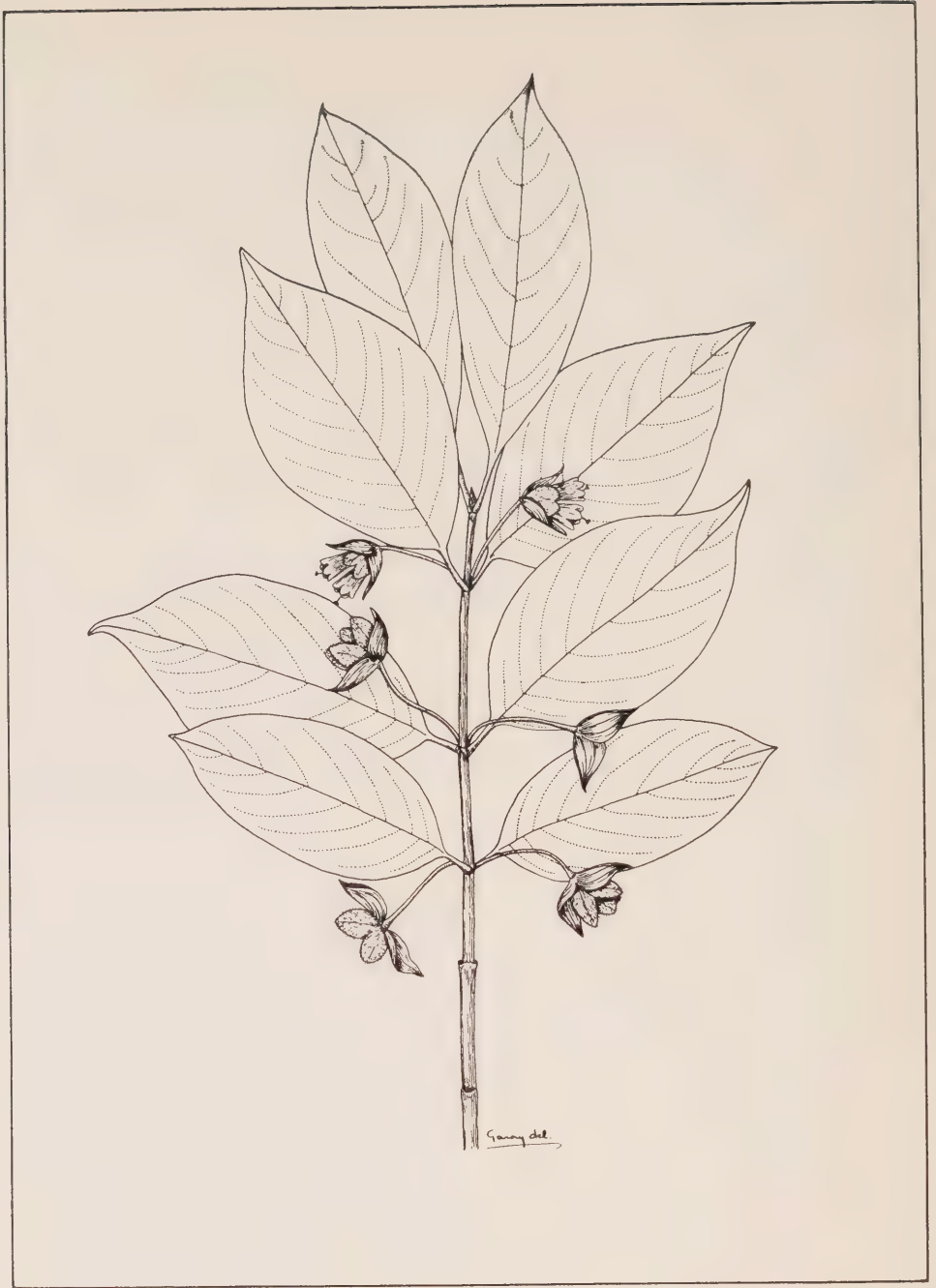
Range - Occasional through most of southern Ontario and and northward to James Bay; common on the west side of the Bruce Peninsula; rare or absent in the Carolinian Zone.

(Western New England to Saskatchewan, south to Nebraska and Pennsylvania.)

FIELD CHECK - Straggling shrub or twining climber; hairy opposite leaves with ciliate margins; upper 1-2 pairs joined across the stem; orange-red berries in stalked clusters.







*Lonicera involucrata* (Richardson) Banks

BRACTED HONEYSUCKLE

Lonicera involucrata (Richardson) Banks    NORTHERN or  
BRACED HONEYSUCKLE

Habit - The Bracted Honeysuckle is an upright shrub with erect or ascending branches, growing to a height of 8 feet.

Twig - The young branchlets are greenish to purplish, smooth or minutely hairy, the twigs are slightly angles or four-sided with solid white pith and gray-brown bark which later begins shredding.

Leaf - The opposite, simple and deciduous leaves are elliptic, oval or obovate, 2 - 6 inches long and 1 - 3 inches wide with an acute or abruptly pointed (acuminate) tip and a rounded or tapered base, dark green and nearly smooth above, paler and hairy beneath, especially along the conspicuous veins. The margin of the leaf has a fringe of white hairs. The petiole is less than 1/2 inch long.

Flower - The flowers, which open in June or July, are narrowly tubular, about 1/2 inch long with erect or barely spreading rounded lobes, yellow or tinged with red and glandular-hairy. They are borne in pairs at the ends of long stout stalks from the axils of the leaves and each pair is subtended by two large pointed green to purple bracts and four smaller glandular-hairy rounded purple bractlets.

Fruit - The fruit, which ripens in July or later, is a pair of shiny purple-black berries, 1/4 - 3/8 inch across, covered by the enlarged bractlets, the outer pair of bracts finally reflexed.

Habitat - In cool moist situations: in swampy woods and thickets, in bogs and along streams and lakeshores.

Range - Michipicoten Island, north shore of Lake Superior and north to James Bay; not recorded in southern Ontario nor south of 47° n. latitude in central Ontario; absent in the Carolinian zone. (Quebec to Western Ontario south to Wisconsin and New Brunswick; Alaska to Mexico.)

FIELD CHECK - Large pointed leaves; purple bracted flowers and fruits on long stout stalks from the leaf axils.







*Lonicera oblongifolia* (Goldie) Hooker

SWAMP FLY-HONEYSUCKLE



Habit - The Swamp Fly-Honeysuckle is a small erect shrub with ascending branches, commonly forming thickets and growing to a height of 4 or 5 feet.

Twig - The young branchlets are green to purplish, smooth or minutely hairy. The older twigs are brownish-gray to blackish with solid white pith and shredding bark.

Leaf - The rather thick opposite, simple and deciduous leaves are sessile or nearly so with a petiole less than 1/8 inch long. The blade is oblong or elliptic to narrowly obovate, 1 - 3-1/2 inches long and 1/2 - 1-1/2 inches wide, rounded or blunt at the tip and tapered at the base, green above and paler beneath, downy when young but becoming smooth in age.

Flower - The flowers, which open in June or July, are yellowish-white, narrowly tubular and about 1/2 inch long, with two spreading lips. They are borne in pairs at the end of a slender stalk up to 1-1/2 inches long arising in the axil of a leaf and the ovaries of each pair are more or less united.

Fruit - The fruit, which ripens in July or later, is a long-stalked pair of orange-yellow to red or purple several-seeded berries usually united for at least half their length but sometimes distinct.

Habitat - Usually in cool moist habitats: marshes, swamps, and bogs or cedar and jack-pine woods, often over calcarous rock.

Range - Common in the limestone areas south and east of the Canadian Shield, on the Bruce Peninsula, Manitoulin Island and north to James Bay and the western part of northern Ontario; rare or absent in the Carolinian Zone. (Southwestern Quebec to Manitoba, south to Minnesota and Maine.)

FIELD CHECK - Low upright shrub forming thickets; leaves oblong; flowers and fruits in pairs on long stalks.







*Lonicera tatarica* Linnaeus

TARTARIAN HONEYSUCKLE



Habit - The Tartarian Honeysuckle is a large erect shrub growing to a height of 10 feet or more.

Twig - The branchlets are slender, smooth and green, later turning brown to brownish-gray. The pith is brown with a central cavity or hollow core.

Leaf - The smooth thin leaves are opposite, simple and deciduous, green on both sides, oblong to oval, 1 - 2-1/2 inches long, 1/2 - 1-1/2 inches wide, pointed, rounded or blunt at the tip and rounded, truncate or sometimes a little heart-shaped at the base with a short petiole 1/4 inch or less in length.

Flower - The flowers, which open in May or June, are numerous, borne in pairs on slender stalks from the axils of the leaves, pink to white in colour, with a short slender tube and long broadly-flaring lobes. The ovaries are separate or slightly united at the base.

Fruit - The fruit, which ripens in June, July or August, is a pair of red to orange or yellow berries, partly united at the base.

Habitat - In open woods and thickets, along lakeshores, edges of cliffs and roadsides.

Range - Introduced and escaped from cultivation in the region south and east of the Canadian Shield, particularly in the Carolinian Zone; Bruce Peninsula; Lake Timagami.

(A native of Eurasia.)

FIELD CHECK - Hollow branches; smooth leaves; numerous long-stalked pink flowers in pairs; twin red berries partly united at the base.







*Lonicera villosa* MICHAUX

MOUNTAIN FLY-HONEYSUCKLE



Lonicera villosa (Michaux) Roemer & Schultes      MOUNTAIN FLY-  
HONEYSUCKLE

Habit - The Mountain Fly-Honeysuckle is a low erect or ascending shrub with stiffly ascending branches usually less than 3 feet high, occasionally forming mats.

Twig - The young branchlets are purplish-red, villous with scattered long soft hairs especially at the nodes. The bark on older twigs is reddish-brown to gray, the outer papery layers soon splitting and peeling to expose the reddish-brown inner layers.

Leaf - The rather firm, opposite, simple and deciduous leaves are elliptic to oblong to oblong-oblongate, 1 - 2 1/2 inches long and 3/8 - 1-1/4 inches wide, rounded or blunt at the tip, sometimes with a minute point, rounded or tapered at the base, dark green and with appressed hairs above, paler and hairy especially along the veins beneath. The hairy petiole is very short (less than 1/8 inch long) or the leaf may be sessile. The margin is ciliate and often slightly revolute.

Flower - The flowers, which open in May or June, are yellowish, tubular to funnel-shaped, borne in pairs at the end of short hairy stalks from the axils of the lower leaves. The two ovaries are partly united and subtended by two narrowly scale-like persistent bracts longer than the ovary.

Fruit - The fruit, which ripens in June or later, is dark blue edible several-seeded berry formed by the union of the two ovaries.

Habitat - In sphagnum or tamarack bogs, swamps, damp thickets and clearings, wet shores and jack-pine plains.

Range - In the upland area east of Lake Huron and south of Georgian Bay, in the Ottawa-St. Lawrence lowlands, more common from Lake Nipissing to the north shore of Lake Superior and the west coast of James Bay; absent in the Carolinian zone. (Newfoundland to Manitoba, south to Minnesota and New England.)

FIELD CHECK - Low upright shrub with peeling papery bark; young stems hairy; flowers in pairs on short stalks with slender bracts.

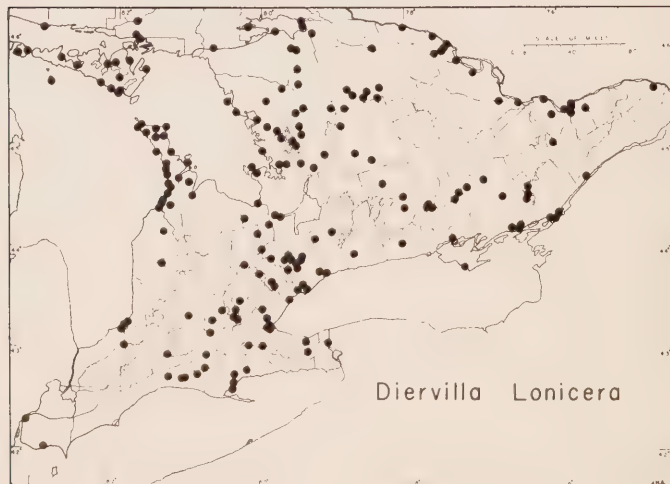






*Diervilla Lonicera* Miller

BUSH HONEYSUCKLE



Habit - The Bush Honeysuckle is a low upright shrub usually less than 3 feet high.

Twig - The young branchlets are green or reddish, often with two lines of tiny hairs running lengthwise along the stem. The older twigs are brownish to gray.

Leaf - The leaves are opposite, simple and deciduous. The blade is oblong-ovate to lanceolate, 2 - 5 inches long, 3/4 - 2-1/2 inches wide, with a long tapering and sometimes curving tip and a rounded, or wedge-shaped, often asymmetrical base, dark green and usually smooth above or hairy on the midrib, pale green and smooth to densely short-hairy below, the margin sharply serrate and with a fringe of short hairs. There is a stout petiole 1/8 - 1/2 inch long. Plants with leaves densely hairy beneath are more common north-westward.

Flower - The flowers are narrowly tubular, perfect, 5-parted, and borne in short-stalked clusters of 2-6 (often in three's) at the ends of the branches and in the axils of the leaves along the stem. They open in June or July and the petals are pale yellow at first, turning to orange or brownish-red.

Fruit - The fruit is a small cluster of brown slender-pointed capsules, 1/4 - 1/2 inch long, ending in a thread-like beak capped by bristle-like persistent calyx-lobes.

Habitat - Usually in dry soil, sandy or rocky woods and thickets or on cliffs, ridges, sand dunes, hillsides or in open pastures.

Range - Common in southern Ontario and north to at least 50° n. lat. (Newfoundland to Manitoba, south to Iowa and North Carolina.)

FIELD CHECK - Low shrub; opposite serrate tapered leaves; clusters of yellow-red tubular flowers and pointed slender-beaked capsules.



**WATER**



## P R E F A C E

During the summer of 1948 the Department of Planning and Development engaged Professor J.D. Lee of Queen's University to examine the Napanee Watershed water problems. His report forms the basis of this report and in part is given verbatim in Chapter 1 Section (4) and in Chapter 4 Section (1). Professor Lee examined the reservoir sites on the Depot River and estimated the storage but no field surveys were made at that time.

In 1950 the Authority engaged the Kilborn Engineering Company and Associates to report on ways and means of providing increased flow in the river and to make a survey of the damsite at the outlet of Second Depot Lake. They submitted a report outlining the storage possibilities of the Depot Lakes and recommended the construction of the Second Depot Lake dam and reservoir. No contour survey was made of this reservoir site at this time and an assumed datum was used for the construction plans. Later the Photographic Survey Corporation of Canada was engaged to prepare a plan of the site showing the township lots and topographical features with contour intervals of 5 feet at Geodetic Survey of Canada datum. This plan was ready shortly after the report was submitted. The description in Chapter 5 of the Second Depot Lake dam and reservoir is a summary from that report.

Except for those items mentioned above this report has been prepared from recent studies made by the hydraulics staff of this Department.

Tenders for the construction of the Second Depot Lake dam were advertised and the contract was awarded to Roadbuilders Limited of Toronto on May 3, 1957, and is to be completed by November 15, 1957, the contract cost of the dam being \$104,720. The Kilborn Engineering Company are supervising the construction.



## CHAPTER 1

### GENERAL DESCRIPTION OF THE WATERSHED

#### 1. Municipalities - Figure 1

The Napanee Valley Conservation Authority comprises the following municipalities and the area occupied by them being, in whole or in part, within the watershed of the Napanee River as follows:

	Population within Watershed by Areal Proportion of Townships
Township of Bedford	106
" " Camden (East)	1,724
" " Ernestown	171
" " Fredericksburgh (North)	390
" " Hinchinbrooke	534
" " Loughborough	56
" " Portland	1,717
" " Richmond	216
" " Sheffield	322
Town " Napanee	4,232
Village " Newburgh	554
Total Population Approximate as of 1957	10,022

Non-incorporated villages and hamlets within the watershed are:-

Hinchinbrooke, Godfrey, Enterprise, Bellrock, Verona, Moscow, Centreville, Colebrook, Yarker, Camden East, Strathcona and Gretna.

#### 2. Dimensions

The Napanee Watershed has an area of 316.3 square miles. It is triangular in shape funnelling into the Bay of Quinte at its junction with Long Reach. It extends north from the bay about 32 miles. Its greatest width east and west is 18 miles at the upper end narrowing to 2 miles at the town of Napanee which is astride the river five miles upstream from the mouth.





PLAN OF  
NAPANEE WATERSHED  
SHOWING  
RIVER AND MAIN TRIBUTARIES  
ROADS AND MUNICIPALITIES  
PROPOSED DAM AND RESERVOIR

SCALE : MILES  
0 1 2 3  
PROPOSED RESERVOIR ■  
FIG. H-1



### 3. The River and Tributaries

Compared to other watersheds in Southern Ontario the Napanee is unique in that it is studded with lakes and connecting streams. The sources of the Napanee River are three main tributary streams, namely: the Depot River, Hardwood Creek and Cameron Creek with its tributary Carmen Creek. The Depot River and Cameron Creek join one mile south of Bellrock and flow into Napanee Lake which also serves as the outlet for Hardwood Creek. The Napanee River proper is from the outlet of Napanee Lake to the Bay of Quinte.

The Depot River is the most important of the above tributaries because it contains a chain of lakes many of which have potential conservation storage. There are six Depot Lakes in the chain, numbered consecutively First Depot Lake, near Bellrock, to Sixth Depot Lake. Another lake in this chain is Wheeler Lake at the headwaters. Fifth Depot Lake has other small tributaries draining directly into it which rise in five small lakes near the boundary of the watershed.

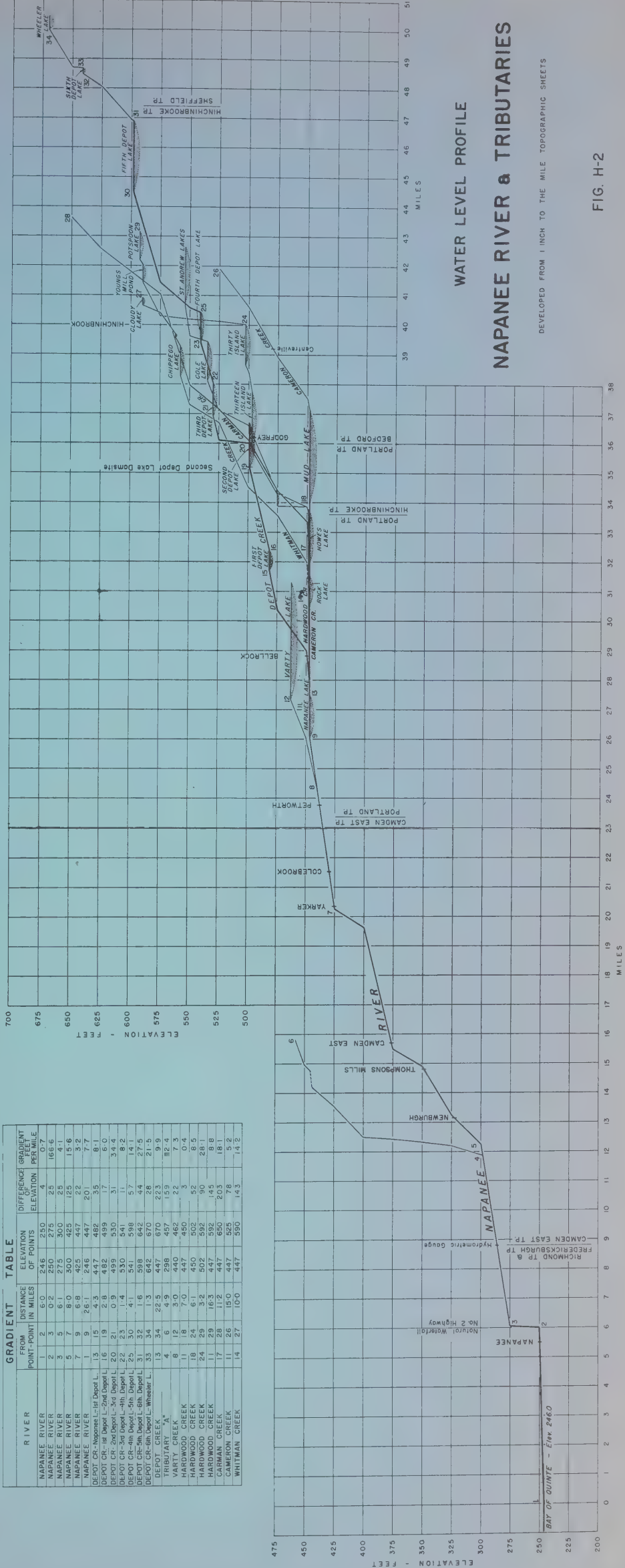
A water level profile and gradient table for the river and tributaries are shown in Figure 2.

### 4. Physical Characteristics and their Effect on the Inhabitants.

The lower part of the drainage basin lies on limestone plains, whereas the northern part of the area covers the rocky knobs of the Precambrian Shield. The physical and chemical characteristics of the water and the manner of run-off from within the watershed reflect the pattern of the underlying rocks.

In general the land is rough and the portion of the drainage basin lying on the Precambrian Shield might well be thought of as undeveloped. In this area all the original timber has been cut or burned, and only in the scattered pockets of the granite outcroppings do sufficiently large soil areas exist to attract even the most frugal farmers.







The lower part of the basin, located in a region of Palaeozoic rocks, has a varying depth of soil cover and, generally speaking, is reasonably fertile land. There are a few industries in the hamlets which border the stream, although at one time many small mills thrived on the power of the river. These industries passed on as the stream flow diminished as a result of the opening up of the upper river to farming practices. In earlier times logging dams and the forest-clad reaches of the upper river had helped to stabilize the flow in spring, summer and fall. The cutting of the forests, the draining of the swamps and the removal of the dams has led to rapid run-off and low summer flow.

No large centres of population exist on the Napanee River. The largest municipality is the town of Napanee which uses the stream as a source of water supply and hydraulic power to operate its water supply system. As already shown there are several hamlets and small villages of which only Newburgh is incorporated.

Although many floods are recorded in Chapter 2 they do not constitute a serious flood problem. On the other hand the development of the stream has led to it becoming a mainstay of existence of the population within the Napanee River Valley. The need for action for water supply, for power development, and for improved recreational facilities is most apparent. The present trend toward improved transportation is leading to a further denuding of the already barren northern area, to the further draining of swamps and thus to further poverty and hardship for those along the entire river. At the present time, there is insufficient river flow in the summer to warrant the capital investment required to support even the smallest industry. It is quite evident that the prosperity of these little mill towns along the stream is intimately connected with the dependability of the stream, and as these communities flourish so do the farmers in the surrounding townships prosper. Action should be taken therefore to sustain summer flow through the building of storage dams.



## CHAPTER 2

### FORMER FLOODS

Present-day knowledge of the severity and frequency of former floods in any part of the Province of Ontario depends upon two things: the care with which such floods were originally recorded, and the preservation of the records for present-day study and examination. In the early days of the settlement of the Province, only the occasional diarist or letter-writer took any pains to set down in writing the record of events; and, as a rule, his observations were limited to his immediate vicinity, and to within a few days of the actual occurrence of the events. It so happens that, in some parts of the Province, careful and consistent records were thus made of floods and other occurrences, in the years before 1800; and that these records have been preserved to the present day. In the neighbourhood of the Napanee Watershed, such records are lacking.

Champlain visited the Napanee and the Bay of Quinte in 1615, in the months of September and October, at a time of year when floods are least likely to occur; he recorded no floods. The first to explore the shores of the Bay of Quinte for the first wave of Loyalist settlement was Lieutenant Solomon Johns, in 1783; his observations were made in the month of October, and he observed no floods.

Whatever may have been the reason, for more than fifty years after the coming of the first Loyalist settlers, there was no record made of floods on the Napanee or its tributaries, that has come to the knowledge of the writers of the present report. As it seems reasonable to suppose that spring freshets and summer flash floods did, from time to time, occur in the watershed, the explanation of this lack must be one of the following possibilities: (1) Floods were not observed, or, if observed, were not recorded; (2) Records of floods were made, but not preserved; (3) Records have



eluded the search of present-day investigators.

The earliest known record of the occurrence of floods on the Napanee is found in the Journal of the Travelling Missionary of the Church of England for the year 1835, and has reference to the rear concessions of the Township of Camden East, and the adjacent parts of the Township of Sheffield. In his journal of the 20th and 21st of October, 1835, the Rev. W.F.S. Harpur wrote:

"On Tuesday (20th) I proceeded into the back concessions of Camden, and the next day (21st) continued my journey into Sheffield. Travelling had now become very tedious; the roads in many places being rendered almost impassable by the late heavy rains - some of the bridges having been carried away, and many of the causeways overflowed."\*

It is evident that, along the route of his journey, Mr. Harpur witnessed a flood condition of considerable severity, by which "some of the bridges" were washed away. What the corresponding conditions may have been in other parts of the watershed can only be guessed.

Forty years were to pass before the next well-authenticated report of a severe flood on the Napanee found its way into permanent record. In 1875, there was a flood on the main stream of the Napanee, severe enough to cause a considerable amount of damage. The report was published in the Toronto Globe, Saturday, April 3, 1875.

"Napanee, Apr. 2.- The ice in the Napanee River is commencing to break up, and great damage to bridges is anticipated. The north half of the bridge crossing the river to Brownstown was carried away last evening (April 1st) by ice, and a gang of men have been at work today breaking the jams of ice and clearing a channel, as fears are entertained for the safety of the new swing-bridge crossing the river to Fredericksburg. Reports come in of a number of bridges that have been carried away on the roads leading from this place. The water is still rising very rapidly.

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\* Waddilove, Rev. W.J.D. The Stewart Missions. London, 1838. Page 119.



"Newburgh, Apr. 2.- The ice in the River broke loose yesterday (April 1st) at noon and rushed downstream in cakes weighing tons. Swept away part of W.H.Eakin's dam, completely demolishing his race. Large cakes of ice now lie on the banks, carried down with the rush. The jam was one time eighteen feet high. Fears were entertained that two bridges would go down stream. The danger is not over."

Despite the suggestions of threats of further danger contained in these dispatches, and the extent of damage already incurred, the newspapers of the ensuing week give no hint of the progress of the floods during the week-end, and make no further mention of the amount of damage done.

In the following year, 1876, according to Mr. George Anson Aylesworth, a life-long resident of Newburgh, a flood carried away one of the bridges by which Main Street, in that village, crosses the Napanee River. All that is known of this flood is contained in a single sentence, written by Mr. Aylesworth, and published in the Papers and Records of the Lennox and Addington Historical Society, Volume 2 (1910), page 33:

"In 1876 the bridge carrying Main street Newburgh over the larger branch of the Napanee River, was swept away."

Ten years later, in 1886, spring floods on the Napanee River "caused considerable damage in Napanee and the county of Lennox." The severity of the floods and the extent of the resulting damage may be judged by the account published in the Toronto Mail, Friday, April 2, 1886.

On Wednesday March 31st,

"the flume of Craig's grist mill in this town (Napanee) was burst, causing a suspension of operations in the mill. As repairs cannot be made till low water is reached, the loss will be considerable. The foot bridge below the Napanee Falls was completely carried away, and the swing bridge was badly injured, the centre pier being moved three feet down the stream by the pressure of floating ice.

"At Napanee Mills (Strathcona) a bridge was lifted off the piers and floated downstream. In North Fredericksburg two bridges were swept away. At Odessa two dams were broken and three or four bridges in the county were destroyed. At other points more or less damage was done. Traffic on the Napanee, Tamworth & Quebec Railway was suspended today because of a number of washouts, but it is expected trains will be through tomorrow."



A few brief notes will suffice to indicate the relatively unimportant floods that occurred during the fifty years following the floods of 1886.

In 1913, a flood was caused in Hinchinbrooke Township by the malicious dynamiting of a dam on April 16th. As a consequence, one man was drowned, attempting to cross the Fifth Lake Bridge.

A photograph, a copy of which is in the offices of the Ontario Department of Planning and Development, said to have been taken in 1928, shows water and ice over the Newburgh Road, at Mink's Bridge. The date has not been confirmed, and other authentic information is lacking.

On January 18, 1929, and again on February 11, 1932, heavy rains resulted in the flooding of many cellars in the Township of Camden East; but it is not recorded that any part of the river or its tributaries overflowed the banks.

According to a Report of the Canadian National Railways, dated December 19, 1950, a flood on an unnamed tributary of the Napanee River, in March, 1933, caused a washout between Napanee and Strathcona that resulted in the derailment of a train.

Whether these were the only occasions in the years between 1886 and 1936, when there were floods on the Napanee, cannot with certainty be known. It seems likely that there have been other times of high water, possible overflow and resulting damage to property; but there is nothing to indicate that such damage has at any time been severe. A close study of the records points to only one sure conclusion, namely, that the records are decidedly meagre and inadequate.

In 1936, two severe floods occurred, the one following hard on the heels of the other. The first of these took place on March 11th, when heavy rains and a sudden thaw brought on a greater freshet than the natural water courses could accommodate. The Napanee Beaver of March 18, 1936, gave the following account of the freshet.



"It is many years since the Napanee River broke up so early and so suddenly. The result was that ice jams formed around the bridge piers and water was dammed back and overflowed the river banks, flooding the surrounding districts.

"During the night on Wednesday (11th), a washout occurred on the C.N.R. Ottawa line, not far from Mink's Bridge on the Newburgh Road . . . . . At Mink's Bridge, on the Napanee River, the ice formed a jam, which dammed the water back, bringing it up to the level of the floor boards of the bridge and causing it to overflow the road to the east approach to a depth of about two feet.

"In Napanee, the ice in the pond above the falls went out about midnight on Wednesday (11th), and the water raced down the falls in a raging cataract. The level land on which the bathing houses are situated, was completely submerged, and the bathing houses were about half under water. Water was rushing over the retaining walls near Springside Park and was flowing down through the park. At the swing bridge, at the foot of Centre Street, an ice jam of chunks of ice about three feet thick formed, and the water rushed through under the bridge as if the river at this point was a rapids. Some fears were expressed for the safety of the bridge on account of the tremendous pressure of the ice and water on the piers.

"The canal which feeds the water filtration plant was overflowing its banks all along its course and water was rushing down the roadway nearby and into the pumping plant through the doors.

"On Wednesday evening the water in the natural watercourse, which flows just west of the Old Belleville Road and under the lawn of St. Andrews Church, overflowed and covered the lawn and roadway to a depth of about two feet. The cellars of nearby residents were flooded . . .

"From the surrounding country reports were coming in that water was overflowing many of the roads ...."

(At Newburgh) "Mr. F. A. Breeze's dam at his mill was carried away by the water raising so high in the river. It was the highest for years and overflowed a long distance inland. A number of cellars were flooded with water a few feet deep."

At Enterprise, cellars were flooded; and the road from Enterprise to Moscow, through the Outlet Swamp, was under water. At various points, railway washouts delayed or prevented the passage of trains.

The floods of the 11th had not long subsided when a further heavy fall of rain, and the breaking up of the ice on the upper reaches of the river, resulted in a second flood, on March 19th. An ice jam on the west side of the swing bridge, at Centre Street, had to be broken up by dynamiting. Another



serious ice jam threatened to destroy a 70-foot bridge over the Napanee River between Camden East and Yarker; a gang of men with axes, poles, and saws succeeded in loosening the jam and in saving the bridge. Again the road and railway through the Outlet Swamp were under two feet of water, and traffic was at a stand-still. Two raceways and part of "the old factory" at Yarker were carried away. At Yarker, also, "there was plenty of water in everybody's cellar."

The second flood was more than usually prolonged. The reports that made up the flood story in the Napanee Beaver of March 25, 1936, indicated the occurrence of high water almost continuously from the 20th to the 23rd; and on April 1st, the Beaver carried a dispatch from Yarker, dated March 30, stating that "the river reached its high mark this spring", which, it seems not unreasonable to suppose, may be a misprint for "this morning".

Since 1936, there is no record of any floods of noteworthy severity, on the Napanee River, or on any of its tributaries.



# N A P A N E E R I V E R

## CHECK LIST OF FLOODS

- 1835 - October 21. Waddilove: "The Stewart Missions", London, 1838: page 119; Journal of Rev. W.F.S. Harpur: "roads in many places being rendered almost impassable by the late heavy rains - some of the bridges having been carried away."  
(Severe)
- 1863(?) Herrington, W.S.: History of the County of Lennox and Addington, 1913: page 318: "At Colebrook, about fifty years ago the bridge was carried away by the spring floods."  
(Severe)
- 1875 - April 1. Toronto Globe, April 3, 1875. At Napanee, bridges damaged, some reported carried away. At Newburgh, an ice jam, damage to a dam, a mill-race demolished.  
(Severe)
- 1876 Herrington, W.S.: History of the County of Lennox and Addington, 1913: page 293: "In 1876, the bridge carrying Main Street, Newburgh, over the larger branch of the Napanee River, was swept away."  
(Severe)
- 1878 - February 21. Toronto Globe, February 23, 1878; Toronto Mail, February 23, 1878. At Napanee, bridges in danger. At Newburgh, threat of damage to mills.  
(Sharp freshet)
- 1881 - March 21. Toronto Globe, March 22, 1881. At Newburgh, a dam and flume carried away.  
(Severe)
- 1886 - March 31. Toronto Mail, April 2, 1886. At Napanee, a flume burst and a bridge carried away. Reports of several dams and bridges at other places damaged or destroyed.  
(Severe)
- 1913 - April 17. Toronto Globe, April 19, 22, and 24, 1913; Napanee Beaver, April 25, 1913. Flood in Hinchinbrooke Township, caused by malicious dynamiting of a dam, resulted in the drowning of one man and the collapse of a bridge.  
(Heavy flood)
- 1921 - (Spring) Summary Report, 1921, Part D, Geological Survey of Canada: page 9D: "The surface has been flooded (near Verona) during the greater part of the spring."  
(Surface water)
- 1928(?) A copy of a photograph, particulars not given, said to be taken in 1928, showing water and ice over the Newburgh Road, at Mink's Bridge.  
(Heavy flood)



- 1929 - January 18. Napanee Beaver, January 23, 1929.  
A heavy rain on the 18th resulted in many cellars being flooded, and the drowning of sixteen head of cattle near Camden East.  
(Surface water)
- 1932 - February 11. Napanee Beaver, February 17, 1932.  
A heavy rain on the 11th, flooded several cellars at Camden East.  
(Surface water)
- 1933 - March. Canadian National Railways Report, dated December 19, 1950. Exact date of flooding not given. At Mile 101.7 from Federal (between Napanee and Strathcona), a flood on an unnamed tributary of the Napanee River caused a washout that resulted in a train derailment.  
(Severe)
- 1936 - March 11. Toronto Mail & Empire, March 13, 1936; Toronto Globe, March 14, 1936; Napanee Beaver, March 18, 1936. Washout, and train derailed near Mink's Bridge; cellars flooded; bridge threatened. At Newburgh, a dam destroyed.  
(Severe)
- 1936 - March 19. Napanee Beaver, March 25, 1936, and April 1, 1936. At Napanee, an ice jam was dynamited. At Camden East, a bridge threatened. Water over the Moscow-Enterprise road. At Yarker, a mill damaged and a raceway destroyed.  
(Severe)
- 1937 - January 19. Napanee Beaver, January 20, 1937.  
Water over the Moscow-Enterprise road.  
(Heavy flood)
- 1947 - May 25. Toronto Globe & Mail, May 26, 1947. At Napanee, streets flooded by a tributary of the Napanee River, and many cellars flooded.  
(Sharp freshet)
- 1947 - June 2. Toronto Globe & Mail, June 3, 1947. At Napanee, the river level up three feet; streets flooded by a tributary of the Napanee River.  
(Sharp freshet)
- 1948 - March 21. Toronto Telegram, March 22, 1948. A trapper reported drowned at Napanee.  
(Sharp freshet)
- 1950 - March 27. Toronto telegram, March 27, 1950. At Napanee, streets flooded by a tributary of the Napanee River.  
(Sharp freshet)
- 1951 - July 5-7. Napanee Beaver, July 11, 1951; Napanee Express, July 12, 1951; Special Report, Napanee Valley Conservation Authority, dated April 16, 1952. Near Napanee, a small farm bridge washed out, two horses drowned. "The highest I have ever seen."  
(Sharp freshet)



## CHAPTER 3

### HYDROLOGY

#### 1. Precipitation, Stream Flow and Run-Off

##### (a) Precipitation

There are no meteorological stations\* on the Napanee Watershed but data available from stations adjacent to the area, with varied length of records, indicate an annual average precipitation of approximately 33.0 inches and an average daily mean temperature over the area of approximately 44° Fahrenheit.

The following table shows a summary of the recorded temperature and precipitation data for the adjacent stations.

Temperatures	Belleville	Kingston	Tweed
	Degrees Fahrenheit		
Average Daily Mean	44	44	43.5
" " Min.	35	36	33
" " Max.	53	52	54
Precipitation	Inches		
Average Annual	31.2	32.8	34.5
Average Annual Snowfall	61.9	62.4	68.1
Summer Rain	8.0	8.5	8.2

##### (b) Streamflow

Streamflow data for the Napanee Watershed are available from 1915 to 1926, and from 1946 to date. The original gauging station was established by the Ontario Hydro Electric Power Commission, but was later taken over and maintained by the Water Resources Branch of the Department of Northern Affairs and National Resources, Ottawa until 1926.

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\* One station equipped with a recording rainfall gauge and maximum and minimum thermometers has now been established at Bellrock.



In 1946 the station was re-established at the request of the Conservation Branch and continuous records have been kept since.

The gauging site is located at Mink's Bridge, 3 miles upstream from the town of Napanee. The original manually read staff gauge was replaced by an automatic continuous recording gauge in 1956. The drainage area above the gauge is 298.2 square miles. A second gauge was established at Bellrock in 1956 but the period of records is insufficient to be of value at this time.

Table 1 shows the maximum and minimum mean daily and mean monthly flows for the period of record, and Figure H-3 shows the hydrographs over the same period.

(c) Run-off

Run-off is that portion of precipitation that finds its way to natural or artificial channels, either as surface flow, or as subsurface flow resulting from infiltration and deep seepage.

The factors affecting run-off are numerous and varied and may be generally classified under two headings, (i) precipitation, and (ii) watershed characteristics.

Precipitation is the most significant since it is the source of all stream flow.

Watershed characteristics appear in so many combinations that it is difficult to classify or rank them in any order in relation to their direct effect on run-off.

The amount of run-off is of great concern to conservation, particularly to the flood control and low flow problems, and as the maximum and minimum values for run-off from an area form the basis for the design of all water control structures.

It is not the ordinary or average flows that determine the design, but the unusual or exceptional extremes of flow that may have occurred in the past or might reasonably be expected to occur in the future that must be used for design purposes.



MAXIMUM, AND MINIMUM MEAN DAILY AND MEAN MONTHLY FLOWS IN CUBIC FEET PER SECOND  
FOR THE GAUGE AT MINK'S BRIDGE ON THE NAPANEE RIVER  
DRAINAGE AREA - 298.2 SQ. MILES

TABLE 1

Year	October			November			December			January			February			March			April			May			June			July			August			September		
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean			
1915-16	-	-	-	245	82	117	224	126	158	1,050	141	307	1,770	219	700	2,800	215	538	2,550	1,340	2,052	1,340	464	899	2,200	805	1,277	1,630	121	519	133	43	73	54	35	43
1916-17	62	38	48	72	22	46	62	24	43	82	44	58	102	29	64	2,480	48	727	2,900	605	1,646	550	166	275	550	114	193	125	31	74	63	18	44	89	14	38
1917-18	427	30	125	424	78	196	226	75	128	84	54	70	350	31	130	2,670	207	1,021	2,820	600	1,646	565	199	320	254	143	197	186	55	149	102	20	55	170	33	100
1918-19	870	108	300	645	500	547	800	398	578	705	268	451	297	112	166	2,530	194	1,021	1,800	670	1,133	1,950	705	1,283	1,430	157	574	230	38	110	58	18	35	38	21	32
1919-20	71	12	40	221	52	163	275	63	145	64	40	45	40	39	40	2,620	1	885	1,640	435	965	525	149	313	137	40	73	138	43	79	52	12	30	43	1	10
1920-21	24	1	9	84	24	51	430	99	333	389	161	245	149	104	130	1,790	130	1,080	1,500	218	745	545	125	278	252	8	56	40	8	22	66	6	37	68	6	39
1921-22	39	1	12	138	16	73	152	90	125	106	63	88	115	54	72	1,640	43	805	1,990	715	1,420	995	288	456	269	117	163	134	72	102	138	67	99	86	3	62
1922-23	73	15	38	23	9	13	31	11	11	31	21	24	20	11	17	474	11	177	2,040	234	1,150	296	484	474	188	357	167	37	98	81	16	39	87	7	53	
1923-24	24	5	16	104	24	44	239	104	178	-	-	230	-	-	217	1,730	-	700	1,710	645	1,180	445	670	396	101	200	101	58	75	69	28	56	69	16	39	
1924-25	152	62	93	67	31	46	-	-	53	-	15	15	1,630	-	438	2,410	640	1,360	1,820	505	905	173	285	259	64	131	97	55	70	97	27	66	33	16	25	
1925-26	38	20	27	525	52	277	-	-	473	-	-	182	-	-	108	975	-	329	2,380	875	1,770	208	665	227	109	168	144	58	93	67	23	45	58	18	40	
1945-46	275	63	210	540	164	256	-	-	-	-	-	-	-	-	-	1,330	125	855	585	145	292	255	99	166	175	85	116	102	13	52	37	2	20	43	6	27
1946-47	74	21	39	106	62	53	496	70	243	-	-	218	-	-	397	2,450	-	520	2,820	870	2,100	367	700	2,250	286	1,080	275	140	181	194	69	114	74	50	59	
1947-48	63	39	50	65	35	51	-	-	91	-	-	-	-	-	-	2,940	-	1,160	2,650	405	1,220	194	194	422	461	110	219	110	9	56	49	-	18	31	4	13
1948-49	43	3	22	220	32	82	131	58	88	-	-	175	-	-	303	2,160	249	691	1,990	345	1,100	413	103	218	86	25	52	43	16	31	34	9	21	44	3	21
1949-50	24	1	5	43	14	25	410	35	148	2,280	338	757	585	145	289	1,780	150	431	3,400	1,050	1,980	126	298	169	31	122	61	19	38	45	6	15	35	3	12	
1950-51	73	23	41	331	41	146	357	142	268	2,580	161	634	1,650	164	417	3,040	606	1,250	2,660	1,070	1,800	142	312	142	28	95	724	43	206	103	40	69	189	73	105	
1951-52	132	85	108	1,000	100	465	1,860	-	626	794	286	502	1,360	224	598	1,170	174	566	2,820	445	1,680	196	312	392	59	169	55	22	38	40	23	34	60	7	29	
1952-53	44	16	33	56	31	39	434	46	162	350	81	140	456	102	171	1,830	167	707	1,650	357	711	294	517	273	81	154	97	24	55	172	33	95	161	51	71	
1953-54	64	31	52	119	11	61	309	123	199	241	110	140	2,010	93	363	2,010	531	1,160	2,420	1,000	1,570	200	599	191	83	134	79	37	55	57	26	39	77	24	46	
1954-55	119	62	95	522	90	254	456	220	290	354	125	208	169	90	114	2,190	143	1,040	2,400	525	1,550	107	218	118	42	68	51	31	40	47	3	23	50	28	38	
average			68			14.5			217			236			248			810			1,360		470			266			102			49			43	



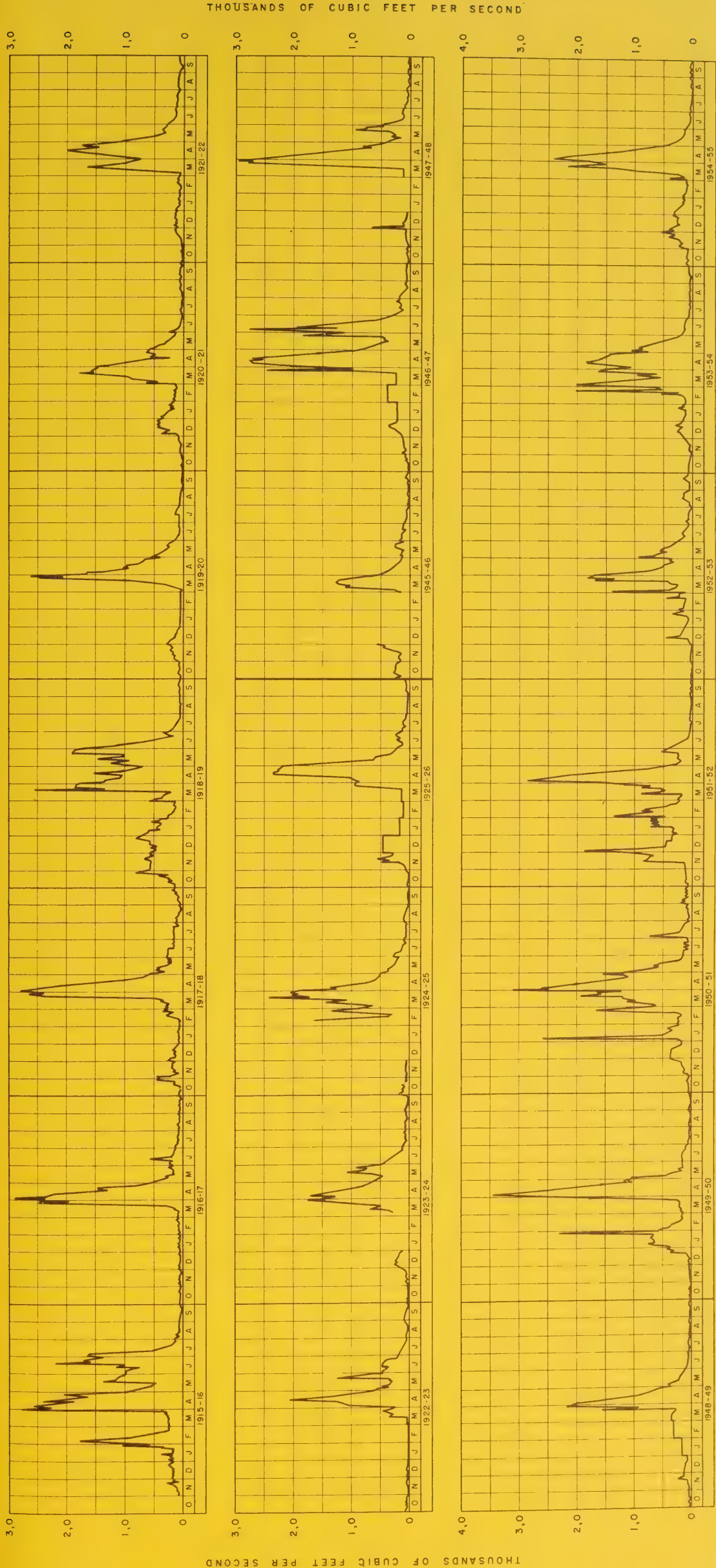


FIG. H-3.

HYDROGRAPHS

MEAN DAILY FLOWS NAPANEE RIVER AT NAPANEE

MEAN DAILY FLOWS PLOTTED FROM RECORDS OF THE WATER RESOURCES BRANCH, DEPT. OF NORTHERN AFFAIRS AND NATIONAL RESOURCES, OTTAWA.



## 2. Maximum Flows

From the available records it appears that the maximum flows on the Napanee River do not approach the magnitude of those of other rivers of comparable size in Southern Ontario.

The maximum recorded mean daily flow over the period of 21 years was 3,400 c.f.s.\*, or the equivalent of 11 c.s.m.† Increasing this by the use of Fuller's formula to an estimated momentary peak flow would give 4,630 c.f.s., or 15 c.s.m.

This is a relatively low rate of run-off for a watershed of this size, and it is obvious that the flood-producing characteristics are such that the probability of major flooding is kept to a minimum. From the flood occurrences as recorded and reported by newspapers and various independent bodies and outlined in this report it might appear that flooding is a major problem on the watershed. However, it is most difficult, and at times impossible, to relate these floods to any hydrologic factors which may be expressed in sound quantitative terms.

Most of the occurrences referred to as flooding, were in the spring period, with an occasional above normal run-off in the summer and autumn seasons. In the period 1835 to the present only 21 floods have been recorded and the magnitude of many of these is doubtful.

## 3. Low Flows

From Table 1 it can be seen that the average monthly mean discharges are lowest for the months of August, September and October. June and July show a fairly high monthly mean but there have been occasions when the daily minimum flows recorded have been as low as 8 c.f.s. during

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\* Cubic feet per second

† Cubic feet per second per square mile.



each month. Discharges as low as 1 c.f.s. have been recorded for the months of September and October, and 2 c.f.s. for August.

The following table shows the minimum recorded flows and the time of occurrence.

MINIMUM RECORDED FLOWS - JUNE TO OCTOBER

Year	Month	Flow c.f.s.	Period Days
1920	September	1	4
1920	October	1	3
1921	June	8	2
1921	July	8	1
1946	August	2	1

There was one occasion when 1 c.f.s. was recorded for March 3 and 4, 1920, but a note was added explaining that ice conditions prevailed from December 6 to March 1 inclusive, and it is probable that this ice condition affected the flows recorded on those days.

There is an obvious need for increasing the flow of the river, and particularly during the months of June to October inclusive. As previously shown the flow of the river is not spectacular in terms of peak stages but the total volume of run-off is large and extends over a comparatively long period.

The following table shows the total run-off for spring freshet periods for 4 years, which were selected as being representative of the average for the period of record.



RUN-OFF  
DRAINAGE AREA ABOVE THE GAUGE AT NAPANEE

Year	Period	Run-Off			*Precipitation Depth Inches On Area	Ratio Run-Off to Precipitation
		Number of Days	Depth Inches on Area	Acre Feet		
1917	Mar.23-Apr.24	33	6.26	99,400	2.80	2.24
1918	Mar.20-Apr.22	34	6.91	109,000	1.89	3.64
1948	Mar.18-Apr.18	32	6.65	105,800	3.16	2.10
1950	Mar.26-May 3	39	7.26	115,300	3.53	2.06

\* Precipitation data from records of Kingston, Belleville and Tweed, when available. Consideration was given to Depth of snow on ground prior to break-up period.

As indicated by the above table there is a greater amount of run-off than precipitation recorded over the same period. This is due to the snow cover remaining on the ground prior to the break-up period, and the accumulated ground water which is given up during the break-up and appears as surface run-off.

Unfortunately there are no accurate data available in this area as to the water equivalent of snow pack prior to the break-up, but it is significant to note the amount by which the run-off exceeds the precipitation and the length of time it takes to run off.

The average ratio of run-off to precipitation is 2.5, which is comparable to the 2.7 for the Grand River during the severe spring run-off of 1947. The most important factor, however, is the length of time over which the run-off occurs. On the Grand River the period of high run-off at Galt, with a drainage area of 1,360 square miles, averages about 12 days whereas on the Napanee River this period often extends over a month or more.

The fact that run-off is extended over such a long period accounts for the low peak flows experienced on this watershed during the spring break-up.



Even though the characteristics of the area with regard to size, shape and physiographic features, do not appear to be conducive to fast run-off, it is quite obvious that run-off volumes are large, and very little percolates or is held in retention to supply stream flow during the months following the spring freshet.

The critical low flow period is July to October inclusive, with August and September showing the lowest average monthly flow over the period of record. Normally there is a surplus flow during the months of March, April, May and June, and the reservoirs would be filled during this period. The driest refilling period occurred in 1946 and the recorded mean monthly flows were as shown in Table 2. Table 2 also shows the maximum and average replenishment and draft periods for the years of record.

From Table 2 it may be noted that the run-off during the replenishment period for the minimum year of record amounted to 86,449 acre feet. The available storage would be this amount less that required to maintain the minimum desirable flow of 60 c.f.s. at Napanee during the four month period or  $60 \times 1.98347 \times 122 = 14,519$  acre feet. Therefore the total available storage would be  $86,449 - 14,519 = 71,930$  acre feet and the portion available above Second Depot Lake would be  $71,930 \times \frac{49.2}{298.2} = 11,850$  acre feet.

With storage facilities this amount of water would be sufficient to supply an additional mean daily flow of approximately 25 c.f.s. during the low flow months of July to February inclusive or a total of 243 days.

The foregoing figures have not been adjusted for losses due to evaporation and seepage, etc.

The most critical period in relation to the occurrence of low flow is July to February, and the minimum period recorded occurred in 1922-23 when the total flow amounted to 22,648 acre feet or an average mean daily of 38.8 c.f.s.



TABLE 2

MONTHLY MEAN FLOWS AND TOTAL RUN-OFF  
FOR THE MAXIMUM, MINIMUM AND AVERAGE REPLENISHMENT AND DRAWDOWN PERIODS ON RECORD

	Replenishment Period - 122 Days						Drawdown Period - 243 Days										
	Mar.	Apr.	May	June	Total*		July†	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.		Total	
					c.f.s.	ac. ft.										c.f.s.	ac. ft.
Maximum 1916	538	2,052	899	1,277	4,766	288,164	206	69	105	108	465	626	502	598	2,679	161,425	Maximum 1951-'52
Minimum 1946	855	292	166	116	1,429	86,449	102	99	62	38	13	19	24	17	374	22,648	Minimum 1922-'23
Average 21 years.	810	1,360	470	266	2,906	175,680	102	49	43	68	145	217	236	248	1,108	66,509	Average 21 years

\* Available storage would be these amounts less the 14,519 ac. ft. required to maintain the minimum desirable flow of 60 c.f.s. at Napanee during the filling period.

† Mean monthly flows for July during the above periods appear to be adequate, but from Table 1 it will be noted that the monthly means for July have often fallen below the desirable minimum, and daily flows as low as 8 and 9 c.f.s. have been recorded. Therefore July has been included in the drawdown period or the period for which added flow from reservoir storage would be required.



If a storage area, or areas, for 11,850 acre feet were constructed above the outlet of Second Depot Lake, and the minimum recorded flows were used for both the replenishment and drawdown periods, a total theoretical flow of 63.8 c.f.s. could be maintained at Napanee during such a low run-off period as that recorded for July to February 1922-23.

The data used here have been in terms of mean monthly and average flows, and it is obvious when dealing with the varying daily flows which may drop as low as 1 c.f.s. the operation of the storage outlets would be important.

The foregoing indicates that sufficient run-off is available, even in the most critical years, to satisfy the demands for water which presently exist.



CHAPTER 4  
THE LOW FLOW PROBLEM

1. The Increase in Flow Required

Any attempt to estimate the quantity of water needed in the Napanee River for increased summer flow is necessarily approximate. By far the largest single user of the stream is the town of Napanee which takes its domestic supply from the river, using water-driven pumps supplemented by electric motors when the stream flow is insufficient to drive the turbines. Some 35 c.f.s. is needed to operate the town's water-supply system and it is perhaps desirable to maintain 25 c.f.s. flowing over the falls at the Town Park both to aid the recreational possibilities of the park and to improve the quality of the water supply for the town by carrying floating debris past the waterworks intake. This flow of 60 c.f.s. is larger than any requirements existing at points higher up on the river and sufficient flow to satisfy this demand would satisfy other users.

The Strathcona Paper Company uses the river for both water supply and sewage disposal and some difficulties exist at the Napanee Waterworks as a result of the ground paper and coal-oil from the Paper Company reaching the river.

The mills which are operated on the Napanee River are conventional grist and sawmills which operate on a run-of-the-river basis making use of the pondage which they control to generate power. In most cases there is insufficient water to permit operation during July, August and September. The owners of these mills form a Napanee River Improvement Company, which holds the water rights of the river by original charter. The problem of estimating the needs and benefits for these mills is difficult, but in any case their demand for water is less than that of the town of Napanee.



Napanee River at  
the village of  
Camden East  
showing good  
early summer flow  
—June, 1956.



Napanee River at  
same site as above  
later in summer.



Napanee River at  
Springside Park,  
Town of Napanee  
showing typical  
stagnant pools  
due to low flow  
conditions.





## 2. Replenishment and Drawdown Periods

### (a) Minimum Storage Required for a Sustained Flow at Napanee of 60 c.f.s.

It has been indicated in the preceding section that sustained flow at Napanee of not less than 60 c.f.s. is desirable. Chapter 3 shows that normally there is a surplus flow in the river during the period from March to June inclusive, or 122 days, and that flow from reservoir storage is required to augment the natural flow during the period July to February inclusive - 243 days - to maintain the desired minimum flow at Napanee. The driest replenishment period on record was 1946 (Table 2) and during this period the average mean daily flow at Napanee was  $\frac{1429}{4} = 357.25$  c.f.s. equivalent to  $357.25 \times 122 \times 1.98347 = 86,449$  acre feet. The drainage area of the Napanee gauge is 298.2 square miles. The unit run-off for this period is therefore  $\frac{86449}{298.2} = 289.9$  acre feet per square mile.

The drainage area of the Second Depot Lake reservoir is 49.2 square miles, therefore the inflow into the reservoir would be  $289.9 \times 49.2 = 14,263$  acre feet.

The driest water year for the drawdown period was 1922-23 and the total of the mean monthly flows for the 8-month period was 374 c.f.s. or an average mean daily flow of  $\frac{374}{8} = 46.75$  c.f.s.

The deficiency at Napanee for the most adverse condition on record is therefore  $60.00 - 46.75 = 13.25$  c.f.s., which for a period of 243 days is equivalent to  $13.25 \times 243 \times 1.98347 = 6,386$  acre feet of storage. This is the net storage or the volume required after losses by evaporation, ice, seepage and dam operation have been accounted for.

It has been calculated that the ice, evaporation and seepage losses for the Grand River system of reservoirs amounted to 7.3 per cent of the net conservation storage and assuming that it would be about the same for the Napanee system and a 5 per cent loss for dam operation the total



loss would be 12.3 per cent. Therefore the minimum gross storage required would be  $6,386 \times \frac{100}{87.7} = 7,282$  acre feet.

The capacity of the Second Depot Lake reservoir is 7,414 acre feet which is about 62 per cent only of the water available for storage in the driest year known. Therefore with efficient operation of the dam there is ample storage to satisfy the present needs of the watershed. However with the ever expanding demand for water, definite measures should be taken immediately to safeguard all available storage areas to ensure adequate water supplies for future needs.

(b) Wettest Replenishment and Drawdown periods on Record - Storage Which may be Held in Reserve and Used During Lean Years

Section 4 of this chapter recommends that all reservoir sites should be developed to their full filling capacity based on the run-off for the average replenishing period Table 2. In this case some of the reservoirs discussed later in section 3, notably the Fifth Depot Lake site, would not fill in the driest year but would for the average run-off period and could be used to hold a considerable amount of storage in reserve for leaner years. In view of the short period of records, the probability that drier periods will occur in the future and the rapidly growing demands for water, this policy is strongly recommended.

The wettest replenishment period on record was March to June 1916. The total flow at Napanee for the 122-day period was 4,766 c.f.s. or an average mean daily flow of 1,191 c.f.s. or 2,362 acre feet per day. The total run-off for the period was 288,164 acre feet of which 288,164 less 14,519 = 273,645 acre feet would be available for storage.

The inflow into the Second Depot Lake reservoir would be  $273,645 \times \frac{49.2}{298.2} = 45,148$  acre feet. The wettest drawdown period on record July to February was 1951-52. The total flow for the 8 months or 243 days was 2,679 c.f.s. or



an average of  $\frac{2,679}{8} = 334.9$  c.f.s. per day. However without regulation there would be periods of water shortages even for this wettest period as indicated by the minimum daily flows of 22, 23 and 7 c.f.s. recorded for July, August and September of this period.

(c) The Average Replenishment and Drawdown Periods on Record

Table 2 shows that for the average replenishment period in 21 years of records the run-off from the area above the gauge was 175,680 acre feet. The surplus run-off would be 175,680 less 14,519 = 161,161 acre feet or  $\frac{161,161}{298.2} = 540$  acre feet per square mile. The flow available for storage from the area above the Second Depot Lake reservoir for this period would be  $540 \times 49.2 = 26,568$  acre feet.

Table 2, also shows that the flow for the average drawdown period in 21 years of records was 1,108 c.f.s. This is equivalent to a mean daily flow throughout the period of 138.5 c.f.s. but flow regulation would be required to ensure a minimum flow of 60 c.f.s. at all times.

3. Reservoir Sites and Means Whereby the Storage Shown has been Estimated

Although the entire basin of the Napanee River is dotted with lakes there are few sites which lend themselves to reservoir development. From the standpoint of loss through seepage and needs of the town of Napanee, storage in the Precambrian Shield is most desirable. Therefore it is fortunate that a number of satisfactory sites exist on the Depot River which at one time had numerous mill or logging dams. One mill at Bellrock is still active and the remains of many others are still in evidence. Table 3 indicates the possible storage on the Depot River. A cursory field examination was made of the sites and the drainage basins generally. The terrain is rough and undeveloped and the sites are only accessible by improved old lumber



TABLE 3  
 APPROXIMATE POTENTIAL STORAGE AND POSSIBLE INCREASE IN FLOW  
 MINIMUM GROSS STORAGE FOR A SUSTAINED FLOW AT NAPANEE OF 60 C.F.S. IS 7,282 ACRE FEET

L A K E				R E S E R V O I R			
DATA IS APPROXIMATE EXCEPTING SECOND DEPOT LAKE WHICH HAS BEEN SURVEYED				Maximum Storage Capacity	Net Storage Loss of 12.3% for Evaporation, Seepage and Dam Operation	Available Increase in Flow June to Oct., 153 days	R E M A R K S
Drainage Area	Elevation of Normal Lake	Area	Depth of Storage above Normal Lake Level Add 5' for Crest of Dam	Ac.ft.	Ac.ft.	c.f.s.	
Sq.mi.	Feet*	Acres	Feet				
First Depot Second Depot† Third Depot ) Fourth Depot)	Unknown 499 530 Unknown	76.2 256.0 153.3 90.2	10 20 20 ) Unknown)	7,414 13,500	6,502 11,840	13.5 24.6	
Fifth Depot	17.1	401.9	6'± 12'	4,957 10,074	4,347 8,835	9.0 18.3	Eliminated - too small  The C.N.R. would cross this concentration. From the topographical sheets a 25' dam at the outlet of the Third Lake appears feasible, but a survey will be necessary to confirm it.  The run-off is 4,957 ac. ft. for the lowest water year on record.
ESTIMATED TOTALS				25,871 30,988	22,688 27,177	47.1+ 56.4±	Build-up of reserve storage.
With 4,957 ac.ft. in Fifth Depot Reservoir with 10,074 ac.ft. in Fifth Depot Reservoir							

\* Lake elevations shown on the topographical sheets published by the Department of Interior.  
 † The Second Depot Lake Dam & Reservoir has been surveyed and the data shown for it is fairly definite.  
 Construction plan, Fig. H-4, shows an assumed elevation for the lake of 100' instead of 499'.



tote roads which are narrow single track, very crooked and hilly and not suitable for heavy motor vehicles.

A preliminary survey and plan has been made for the Second Depot Lake site and the storage shown in Table 3 is fairly definite. That shown for the other lakes should be considered as an indication only. A line of levels will have to be run to determine the elevation of the lakes shown and the height of the dams possible at their outlets and contour plans prepared before a decision can be made for the next site to be developed. The areas of the lakes shown in the table were planimetered from aerial photographs and these areas are sufficiently reliable for preliminary estimates. The depth of storage on the lakes and the water level profile, Figure H-2, were developed by interpolation of the 25-foot contour intervals shown on the published topographical sheets. By this means the depth of storage could be in error by several feet, which would amount to considerable difference in storage capacity. It is obvious therefore that further preliminary surveys are necessary for the unsurveyed sites. In particular contour surveys will be necessary to cover the Third and Fourth Lakes. Dams could be built at the outlet of each lake but there is a possibility that one high dam at the outlet of the Third Lake would provide considerably greater storage at less cost provided that such a scheme would not interfere with the C.P.R. line which crosses the river between the two lakes.

#### 4. Conservation of Water

An adequate supply of good water is essential for the well being, development and growth of the watershed. Its uses are many, namely: domestic, power, industry, dilution of pollution and irrigation. No matter how efficient sewage treatment plants may be their effluent has to be diluted by a considerable flow of good water to make it satisfactory for other purposes. Irrigation in very dry years requires



up to  $1/4$  of an acre foot or  $1/8$  c.f.s. for every acre of land irrigated. Little or none of this water is returned to the river, but is lost by evaporation and transportation. Should the Cameron Swamp be reclaimed for market gardening there would probably be a larger demand for water for irrigation which could be supplied from the Depot Lake system of reservoirs or, preferably, a reservoir at Mud Lake. Vast amounts of capital both Canadian and foreign are being invested in Canada and there is unprecedented development and prosperity. There is no reason why the Napanee Watershed should not share in it also. No-one can visualize what the growth will be in, say, 25 years or even 10 years. It can be said however that it would be limited to the water supply. Water could be pumped from deep wells or the Bay of Quinte but the logical means of increasing the supply is by impounding some of the spring run-off which runs to waste. Therefore, good reservoir sites should be regarded as vital assets. There is no suggestion that dams should be built until they are needed but the reservoir sites should be purchased now while land values are low. Should any corporation become interested in any part of a reservoir site land values would increase greatly.

If years later it was definitely known that the sites would never be needed they could be sold possibly with no loss in the investment.

All reservoir sites should be developed to at least average filling capacity, since any attempt to increase the height of a dam later would be impractical and an expensive undertaking.

Contour plans of the Third, Fourth and Fifth Depot Lake sites, to show the lands that would be flooded by reservoirs at these sites, will be prepared at an early date to enable the Authority to acquire the necessary lands should they decide to do so.



5. Merits of the Reservoir Sites

The storage in the First Lake is too small for conservation and this site was eliminated.

A single concentration at the outlet of the Third Lake which would drown the Fourth Lake is proposed if feasible. The C.P.R. crosses in between these lakes and if a dam 25' high would allow sufficient clearance under their bridge crossings about 13,500 acre feet of storage would be available. The total inflow for the lowest run-off period is only 11,016 acre feet, but for the average period is 22,386 acre feet. According to the records, there was only one year, namely the one shown, that the replenishment period run-off was less than 13,500 acre feet, so that an average drawdown discharge of 28 c.f.s. is almost assured.

The Fifth Lake is much larger than the other Depot Lakes and being near the headwaters has the best strategic location. It has a small drainage area however (17.1 sq. mi.) and the replenishment for the lowest period is only 4,957 acre feet which is equivalent to a depth of water above normal lake level of about 6'. The storage on this lake however should be developed at least for the average replenishment period, viz: 10,074 acre feet, or a depth of water of 12 feet and storage built up and held in reserve for lean years. For the same reason with a survey of the site and further study, a reservoir which would hold the run-off for the maximum replenishment period run-off, namely, 16,524 acre feet or a depth about 20 feet, might be considered. Such a dam would be a long one but the spillway capacity would be only a fraction of the other sites, and large increase in storage could justify the extra cost.

In either case with a depth of storage of 12 or 20 feet, the built-up reserve could be used, if desired, to regulate the levels of the reservoirs downstream should it be desirable to operate these within close limits.



As stated previously, there will be sufficient storage in the Second Depot reservoir for the present. Therefore storage on the other sites is for future consideration when demands for water will be better known.



## CHAPTER 5

### SECOND DEPOT LAKE DAM AND RESERVOIR

(See Figure H-4)

Second Depot Lake, as its name implies, is the second of a series of lakes on the Depot River. It fills a comparatively steep-walled depression in the Precambrian rock of the Canadian Shield and has a surface area of 256 acres. The total drainage area of 49.2 square miles above the proposed damsite would need a surface run-off of less than 3 inches to fill the storage capacity of 7,414 acre feet.

The dam is located at the outlet of the lake in Lot 4, Con. VIII, Twp. of Hinchinbrooke. It will consist of an earth fill structure, with concrete spillway and control section, 185 feet in total length and with a height above low water of 25 feet. Protection against seepage is ensured by an impervious core, keyed to the bedrock, with wood sheetpiling in the central portion. The earth embankment will have a crest width of 12 feet, freeboard of 5 feet, with upstream slopes of 1 in  $2\frac{1}{2}$  and downstream of 1 in 2. Both slopes will be protected by 2 feet of riprap and having toe drains of 4-inch tile in rockfill.

The concrete control structure, located at the west end of the dam, will be dowelled into the solid bedrock. It will consist of a 4-foot diameter discharge tube with invert at elevation 99.5\* controlled by a manually operated sliding sluice gate. The discharge tube, under full head would have a maximum flow of 320 c.f.s. A stop log section with a width of 8 feet and a depth of 15 feet will discharge another 1,400 c.f.s. and additional stop logs above the sluice gate down to elevation 114 provide a further spillway capacity

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\* All elevations are referred to an assumed datum of 100.0 for low water elevation at the lake outlet.



Damsite at outlet of Second Depot Lake looking upstream from road crossing. Dotted line indicates top of proposed dam.



Road crossing below damsite showing profile of valley. Broken line in this photograph indicates top of proposed dam.



View of typical land to be flooded by the new reservoir.





of 400 c.f.s., or with all outlets open, a total discharge capacity of 2,120 c.f.s. will be provided. This is equivalent to a run-off of  $\frac{2120 \text{ c.f.s.}}{49.2 \text{ sq.mi.}} = 43.1 \text{ c.f.s. per square mile.}$

To permit access to the discharge tube, a set of emergency stoplogs is provided to close off the channel, and further protection is provided by a trash rack at the inlet.

The reservoir is all included in the Township of Hinchinbrooke, County of Frontenac, and extends over all or parts of: Lot 4, Cons. VIII, IX; Lot 5, Cons. VII, VIII and IX; Lot 6, Cons. VII, VIII; Lot 7, Cons. VI, VII; Lot 8, Cons. VI, VII, and Lot 9, Con. VI, with a total water surface area of 471.7 acres. Of this area, 214 acres would be newly flooded. To control the shoreline by acquiring a strip 350 feet in width would necessitate the purchase of a further 775 acres, which would include the point between the two arms of the reservoir.

The reservoir is crossed by a transmission line of the Hydro-Electric Power Commission but no towers are affected by the flowage.

The roads lying in the reservoir are second-class township roads, and only short lengths are affected. Re-grading over a length of 3,185 feet and construction of 2,600 feet of new road will be necessary, as shown in Fig. H-4.

The total cost of the dam and reservoir including land purchases, roads and bridges and engineering will be approximately \$150,000.







## ABBREVIATIONS, EQUIVALENTS AND DEFINITIONS

### Abbreviations

ac. ft.	is the abbreviation for <u>acre foot</u> which is equivalent to 43,560 cubic feet and is the quantity of water required to cover one acre to a depth of one foot.
c.s.m.	is the abbreviation for <u>cubic feet per second per square mile</u> and is the average number of cubic feet of water flowing per second from each square mile of drainage area.
c.f.s.	is the abbreviation for <u>cubic feet per second</u> and is the unit generally used to express discharge or the rate of flow.
M.P.N. or m.p.n.	most probable number
ML or ml.	millilitre
P.P.B. or p.p.b.	parts per billion
r.P.M. or p.p.m.	parts per million
PH or ph	value measure of acidity or alkalinity

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### Equivalents

1 c.f.s.	= 6.25 imperial gallons per second
1 c.f.s. for 1 day	= 1.98347 acre feet or approximately 2 acre feet
1 c.f.s. for 1 year	= 724 acre feet
1 ac. ft.	= 271,472 imperial gallons
1,000,000 imperial gallons per day	= 1.86 c.f.s.

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### Definitions

BOOST STORAGE is the storage required to increase the head of water over the discharge tubes in order that they may be able to discharge the required flow.

CHANNEL CAPACITY or "IN-BANK" FLOW is the maximum flow which is contained within the river banks and does not overflow the adjacent low lands.

CHANNEL CAPACITY STORAGE is the volume of water that must be impounded in order that the stream flow will not exceed the channel capacity flow or stage.



**WILDLIFE**



## CHAPTER 1

### INTRODUCTION

Adequate planning for wildlife in Southern Ontario is very important. The hunter and fisherman regard the opportunity of seeking game and fish with a reasonable chance of success as healthy pursuits of the highest order. The money derived by the fur trapper from the sale of furs is also an important item of income. The increasing numbers of naturalists, photographers and other private citizens who enjoy a drive through the countryside derive great satisfaction and pleasure from seeing the varied forms of wildlife in attractive environments.

With careful handling of the places in which the various kinds of wildlife live and by managing their numbers, wildlife populations should have no adverse effect on most good land use practices. Indeed, the best farm husbandry, the best land management and the best methods of handling woodlands normally go hand in hand with good wildlife conditions. Thus the control of undesirable or harmful species of animals, while the more desirable or less harmful ones are maintained by habitat manipulation, hunting, fishing, trapping and other sound wildlife management techniques, becomes an essential branch of good land management.

Planning for wildlife in Ontario is already the full-time occupation of an entire division of the Provincial Department of Lands and Forests. A District Biologist at Tweed and a group of Conservation Officers strategically placed through the country provide advice to the average citizen. The present report, based on a short-term examination, deals only with a few specific problems in this watershed and a single problem, improving the farm for wildlife, which is of much more general application.

The Napanee Watershed appears to have four major types of land and water from the point of view of wildlife. The whole of the north and north-eastern section



consists of woodland and scrubland (much burned and in part overgrazed and also eroded to bedrock in many places) and about thirty lakes and a great many small ponds. Many of the lakes contain excellent fishing. The land consists of many low, rounded hills surrounded by marshes. The second land type is the 8,000 acres of the Cameron Swamp, which is very poorly drained. The more southern part of the watershed consists chiefly of shallow-soiled land over limestone, which is partly cultivated or pastured. Lastly there is the valley of the Napanee River itself. This is a fertile area of debris filling a wide cut in the limestone itself. The present river is of course much smaller than the former one, and now falls about 200 feet from the vicinity of the Cameron Swamp down to Napanee. Most of the settlements along this part of the river's course are naturally to be found where the larger falls or rapids occur, since these supplied a head of water for power and an impounded reserve for use in any other plant operation.

The specific subjects discussed in this report are; the value of the Cameron Swamp for wildlife; data concerning eight of the lakes; the suitability of the river for fish; and the pollution of the river above Napanee in 1956.



## CHAPTER 2

### THE WILDLIFE OF THE CAMERON SWAMP

Because the future of the Cameron Swamp is discussed in some detail in other sections of this report, a general summary is made here of the present significance of the swamp for wildlife. The chief source of the following information was the District Biologist\* of the Department of Lands and Forests at Tweed.

#### WHITE-TAILED DEER

The area known as the Cameron Swamp is not considered important as a deer-hunting area.

The chief reason for the absence of deer as a permanent population in the Cameron Swamp is the high water level and flooding of the swamp which takes place during any rainy autumn season. In winter the swamp is still flooded and freezes over. This is hardly a suitable habitat for wintering deer since most of the tree growth in the swamp is tag alders, soft maple, black ash and elm. The swamp does not usually dry up until June, and at this time deer in the surrounding area may migrate into the swamp. In those seasons when the swamp does dry up early, some does give birth to their fawns on some of the higher, dry areas of this region, so there is a small population remaining in the swamp during the summer. Virtually no deer are shot during the open season in the swamp.

#### RED FOX

Foxes appeared to be plentiful in the low-lying areas of the swamp in the winter of 1956-57, and many tracks could be seen on the snow-covered ice surface of the swamp when it was visited by the District Biologist. Farmers in the area say that the edges of the swamp have become a haven for foxes, which go out to the surrounding farms and prey upon their poultry.

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\* R. E. Whitfield.



#### BEAVER

Beaver are not common to this area, but a few pelts are taken by trappers annually. The general lack of poplar in the swamp may be the reason for their scarcity.

#### MUSKRAT

Muskrats are found in fair numbers along the course of Cameron Creek, which flows through the central area of the swamp, but in its present condition the swamp is not an important muskrat-producing area. The fluctuating water levels are no doubt the chief reason for this condition. The large wooded areas of the swamp of course do not contain ample supplies of cattails, sweet flag, or other useful muskrat foods.

#### BRUSH WOLVES

Some brush wolves are known to inhabit the general area of the swamp and are occasionally seen along the perimeter.

#### RACCOON

Raccoons are common in the swamp, but very little trapping for them is carried on. However, the farmers occasionally hunt them with dogs for sport.

#### MINK

Mink are taken at intervals along the river courses by trappers, but they are not considered plentiful.

#### OTTER

One otter slide was noted deep in the swamp on the bank of Cameron Creek early in 1957. However, trappers state that otters are scarce.

#### WATERFOWL

Some black ducks nest in the Cameron Swamp along the river edges and at the edge of Pond Lily Lake and Napanee Lake. But these areas do not provide very important nesting grounds. Wood ducks, which nest in trees, are fairly numerous in the swamp.



Duck hunting is said to be reasonably good in some parts of the 8,000 acres of the whole swamp. Wild rice grows in the shore areas of Napanee Lake, Pond Lily Lake and Lost Channel, but there is no wild rice in the vast general region of the swamp itself.

#### UPLAND GAME BIRDS

##### Ruffed Grouse

Ruffed grouse appeared to be the only species of upland game bird found in the Cameron Swamp. These birds occupy the islands within the swamp, and they are hunted to some extent during the open season. Some of them spend the winter in the swamp.

#### BULL FROGS

Bull frogs were said to be plentiful in the swamp in former years, but later the population fell to a low level. They appear now to be on the increase. In previous years they were sought after by various people on a rather large scale, and this may have contributed to their decline.

#### SMALL MAMMALS

Since the water level in the swamp is always very high in spring, there can be no very large population of terrestrial small mammals in the swamp. The swamp does not appear to be good habitat for shrews, moles, deer mice, meadow mice or jumping mice except on a few of the higher islands in the swamp .

#### BIRDS

It is probable that about 280 species of birds live in or migrate through the watershed, but only about 120 species remain during the summer to nest in the watershed. One hundred and fifteen species of birds were observed as resident in the nearby Moira Watershed in the summer of 1948 by the Department of Planning and Development's survey party.



Of these probably 60 or 70 species might be found within the area of the Cameron Swamp in summer. No attempt was made to make an adequate list on the Napanee survey.

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Summarizing the above information, it does not appear that the present wildlife in the Cameron Swamp has any great monetary value. As is mentioned in the Land Use section of this report an increase in the number of drainage ditches would probably increase the population of muskrats considerably. The most useful conclusion is this, that before any major change in the land use of this area is planned or considered, a careful appraisal of the present or potential crop of sawlogs, fuelwood and fish and wildlife should be made, which would accompany an investigation of the swamp's ability to increase or decrease the flow of the Napanee River.

Naturally the Cameron Swamp is a most useful storage basin for delaying the spring run-off into the upper Napanee River and for reducing excessive flows after heavy rains. It benefits fish by keeping a more equable flow in the river in these periods. The establishing of a gauge at Bellrock should give a clue to the effects of evaporation from this marsh during the summer. These effects on the flow of the river (and consequently on the fish populations) are at present unknown. Any additional gauges which could be placed around this marsh would provide important fundamental data on the contribution of swamps to the water economy of a watershed, which are not now available in Ontario.



## CHAPTER 3

### IMPROVING THE LAND FOR WILDLIFE

The many varied types of land in the Napanee Watershed have already been mentioned. The requirements of food and cover vary greatly for different species of wildlife. The recommendations listed here are therefore those which can be most generally applied by the landowner.

#### 1. Woodlands

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Reforestation plans are included in the Forestry Report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after about the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will therefore come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas and who wish to produce a proper environment for wildlife will find that release cuttings, slashings to stimulate sprout growth, thinings and felling timber for sale will improve rather than retard the carrying capacity for wildlife. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

#### 2. Cultivation Practices

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report,



is of particular value, since by this means no extensive area is denuded of cover at one time by harvesting. In the less flat parts of the agricultural section of the watershed filter strips, either above water diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now becoming more common in the Napanee Watershed. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. Rosa multiflora is an excellent hedge-forming shrub. It has a tendency, in Southern Ontario, to die back in winter but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground. However, in view of its questionable hardiness it should not be planted in the Napanee Watershed without consultation with the nearest biologist or forester of the Department of Lands and Forests at Tweed.

The following are a few species of plants which are of particular value as food for wildlife. Those marked with a star (\*) can usually be found growing on some part of every farm.

\*Wild Grape - This plant provides excellent wildlife food and cover, but it forms such a dense tangle over fences and young trees that it should only be planted where it can be carefully watched and controlled.



Hairy Vetch - This plant can be grown on poor, sandy soil. Cottontails and the European Hare use it for food and cover. The seeds are eaten by a great many of the ground-feeding birds.

European Millet - This plant fruits profusely and the seed attracts vast numbers of birds. It is grown commercially for bird seed.

\*Elderberry - A great many species of birds feed on the small black juicy berries, and there are not often many of the fruits left in winter. However the birds, once attracted, will return to feed on other fruits.

Mountain Ash - Mountain Ash is both a very attractive tree in appearance and also a most useful tree for its scarlet fruit.

Corn - A few rows of uncut corn standing in a field or garden will provide excellent cover and a continual supply of food for the larger birds, including the Ring-necked Pheasant and the Hungarian Partridge. Cracked corn is useful for smaller birds. Corn left near streams will almost certainly be destroyed and the cobs eaten by raccoons. At present there are probably no Hungarian Partridges in the watershed, although they thrive both east and west of it in various parts of Ontario. The Authority might urge an experimental introduction of the species, when the present population near Winchester, Ontario, reaches a high level.

There are many other plants that could be recommended for use as cover, food or nesting sites. The best general reference book on this subject, for birds of the Napanee Watershed, is "Planting Your Garden for Wild Birds" by James R. Mackintosh, published by the Audubon Society of Canada, 181 Jarvis Street, Toronto, Ontario.



### 3. Field Corners

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four fields may be made into a haven for ground-nesting species by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation, which is bluegrass.

### 4. Ponds and Streams

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will create a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible, ponds for wildlife should be separate from those intended for cattle or for fish. Willow cuttings pushed in the ground around such a hollow will rapidly provide wildlife cover. New water areas are usually very rapidly invaded by aquatic plants, but additional species may have to be introduced. No extensive duck food studies have been made in Southern Ontario. Wild rice may be introduced, but since it is not well adapted to wide variations in water levels during its growing season, being often sterile in fluctuating waters, it cannot be considered as certain to succeed. The seed must be kept wet from the time it is harvested until it is sown (or broadcast) on the water surface. The idea has long been current, and fostered by many sportsmen's organizations, that the growing of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of little significance to ducks in Canada except in the fall, and does not provide good cover or nesting sites.

The following species, which may be easily obtained, are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks, they can be introduced. All of them are hardy in Southern Ontario.



Sago Pondweed	<u>Potamogeton pectinatus L.</u>
Red-Head Pondweed	<u>Potamogeton Richardsonii</u> <u>(Ar. Benn.) Rydb.</u>
Wild Millet	<u>Echinochloa crusgalli (L) Beauv.</u>
Japanese Millet	<u>Echinochloa frumentacea</u> <u>(Roxb) Link</u>
Wild Celery	<u>Vallisneria americana Michx.</u>
Knotweed	<u>Polygonum pennsylvanicum L.</u>
Water-Smartweed	<u>Polygonum coccineum Muhl.</u>
Three-square	<u>Scirpus americanus Pers.</u>
Great Bulrush	<u>Scirpus validus Vahl., var.</u> <u>creber Fern.</u>
Duckweed	<u>Spirodela sp. and Lemna sp.</u>

Those who are interested in farm ponds for wildlife will find very useful details of the various types of pond and methods for constructing each type in a booklet, "Farm Ponds", which is available from the Provincial Department of Agriculture.\* Farm ponds differ from those intended for wildlife in that care is usually taken to prevent the growth of aquatic vegetation in a farm pond intended only for watering stock or fire protection purposes. Otherwise, the construction and details of ponds for wildlife should follow one of the types there described.

Algae in ponds are often only present for a short time and will disappear in a month or so. A concentration of .5 p.p.m. of copper sulphate will destroy them temporarily at least. The larger aquatic vegetation, if too abundant, cannot be removed except by cutting (a heavy chain is useful), by draining the pond or by the use of 2,4-D for emergent vegetation or poisonous compounds such as sodium arsenite for submerged plants. These compounds will of course kill fish also, and the use of this method requires permission from the Provincial Department of Lands and Forests and the Water Resources Commission of Ontario if the treated water flows into any other privately owned or public waters.

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\* Applications may be made to the nearest Provincial Agricultural Representative or to the Department of Agriculture, Parliament Buildings, Toronto.



## CHAPTER 4

### FISH

#### 1. Introduction

The original purpose of this survey was to classify the waters of the Napanee drainage basin as to their present suitability for fish and, if possible, to make recommendations for improvements with examples in detail. It was soon found that this could not be carried out in full, because there are more than 20 lakes within the watershed, some of them inaccessible by vehicle, and also several hundred miles of watercourses running through land untouched except by fire and logging. There was also a severe problem in pollution to be examined. The original plan was therefore adapted as follows,

#### 2. Methods

It was felt that for fish management of the lakes the primary necessity would be to map the contours and temperatures of those lakes which could be reached easily, so that the depth and volume of each lake could be determined. This procedure was carried out for eight of the larger and more accessible lakes. This work took up much of the time of the survey. Gill nets and small seines were also used to acquire some information on the species present in each lake. This was by no means complete as the gill nets were set for only two nights. No attempt was made to make quantitative estimates of the fish populations.

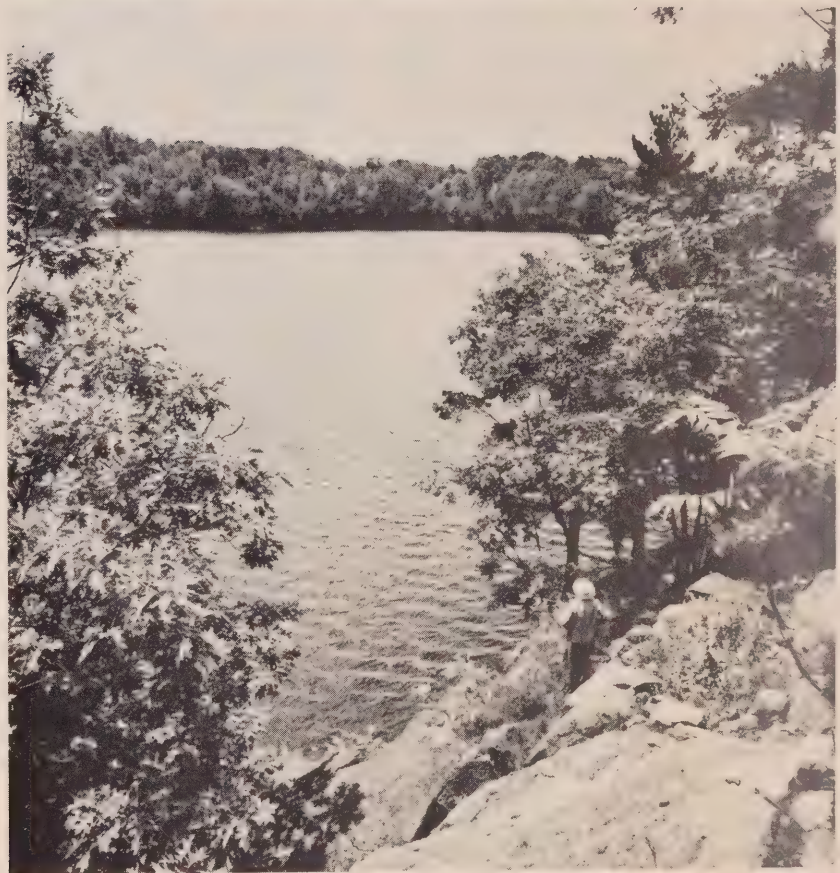
At 35 stations on the Napanee River and its major tributaries methods of survey were adopted which followed closely those used in previous surveys made by the Department of Planning and Development in other river systems. The stations were from half a mile to three miles apart on each stream course. The topographic features of the valley and the erosion, vegetation, volume of flow, turbidity, temperature and type of bottom were listed for each station.



An attractive stretch of the Depot River half a mile north of Bellrock. The flow of this river will be increased in summer by the planned Second Depot Lake Dam.



The steep and rocky shores of Fourteen Island Lake in Loughborough Township. This is one of the deepest lakes in the watershed. At present it is quite unspoiled. There is an abandoned open pit feldspar mine nearby, now filled with water.



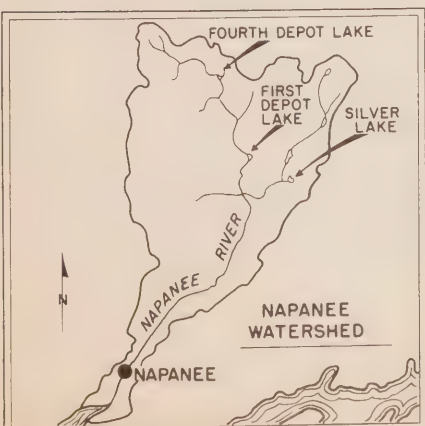
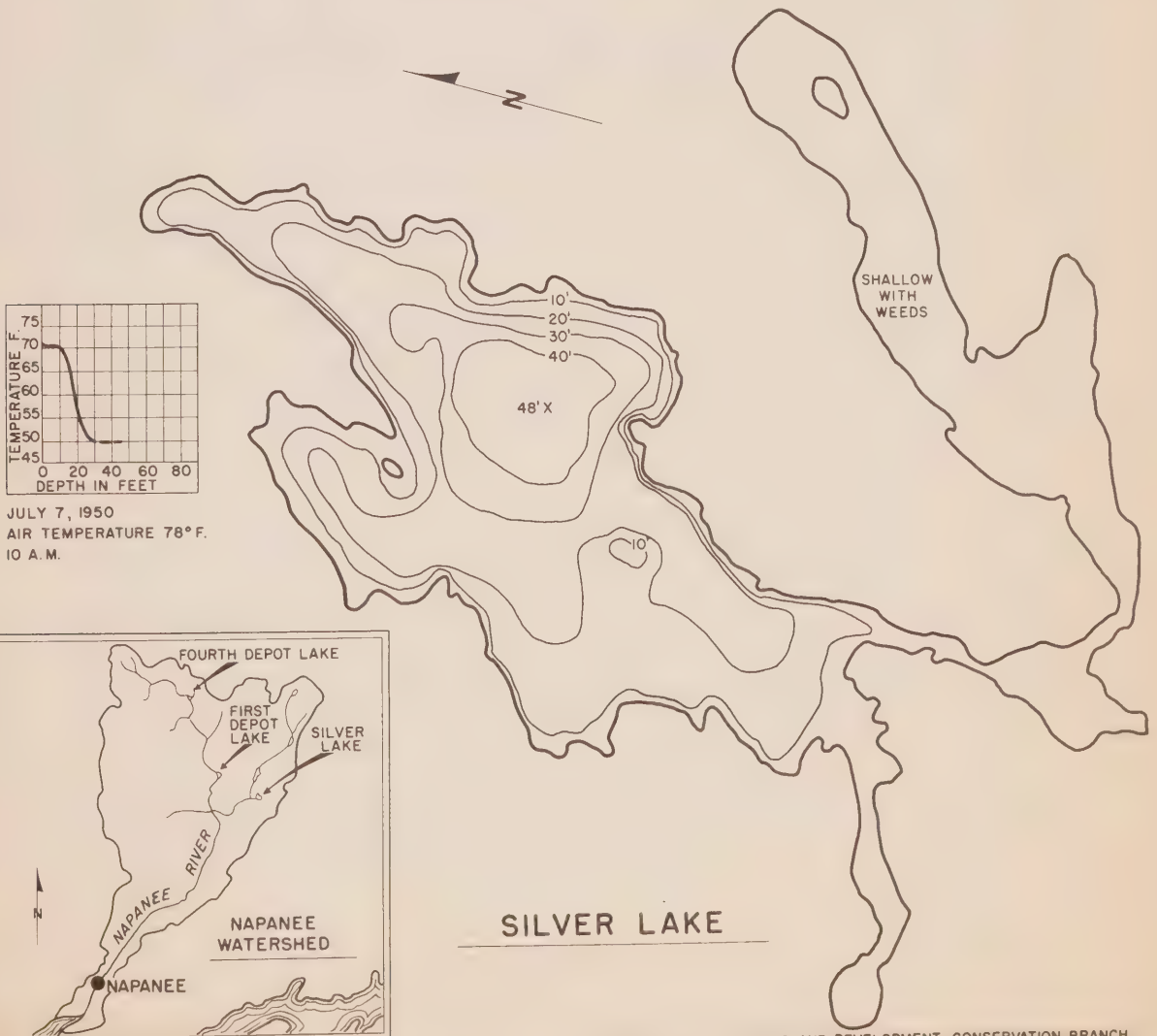
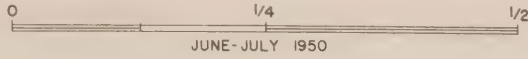
Cameron Creek, seen from the road south of Bellrock.





# LAKE DEPTH CONTOURS & TEMPERATURES

SCALE: MILES





At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made, and these collections were later examined and classified and were used in zoning the various sections of the river.

Many aquatic insects such as mayflies, stoneflies and caddisflies are reliable indicators of the stream conditions at the critical time of year. Some are confined to waters which remain cold and clear in summer, such as trout waters. Others are indicators of permanent flow or of polluted water or of the maximum summer temperature of the water. Thus the potentialities of a stream for particular species of fish are indicated. Fish collections and records of maximum-minimum thermometers substantiated these findings at their particular stations. Since the procedure here used follows that of other river surveys, it allows close comparisons of the characteristics of many rivers. The present criteria and methods were developed from more intensive year-round research carried out by Dr. F. P. Ide of the Department of Zoology, University of Toronto, in many parts of Ontario. Since many of the streams were examined only once, it was necessary to rely chiefly on deductions made from the presence or absence of species known to be reliable indicators\*.

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\* Ide, F.P. The Effect of Temperature on the Distribution of the Mayfly Fauna of the Stream. University of Toronto Studies, Biology 39, Ontario Fisheries Research Laboratory, Publication 50, 1935.

Ide, F.P. Quantitative Determination of the Insect Fauna of Rapid Water. University of Toronto Studies, Biology 47, Ontario Fisheries Research Laboratory, Publication 59, 1940.

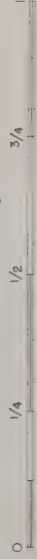
Sprules, W.M. An Ecological Investigation of Stream Insects in Algonquin Park, Ontario. University of Toronto Studies, Biology 56, Ontario Fisheries Research Laboratory, Publication 69, 1947.

Hallam, J.B. Habitat and Associated Fauna of Selected Species of Fish in Ontario Streams. M.A. Thesis, University of Toronto, 1954.

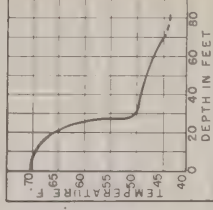
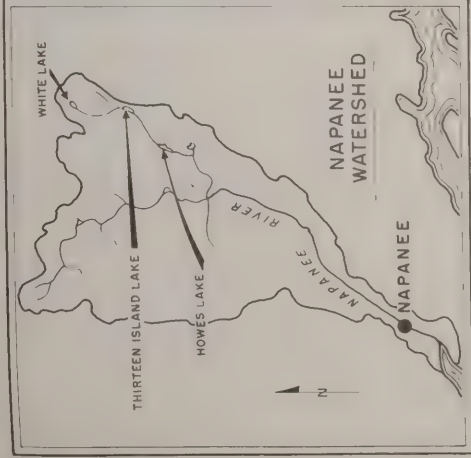


# LAKE DEPTH CONTOURS & TEMPERATURES

SCALE : MILES

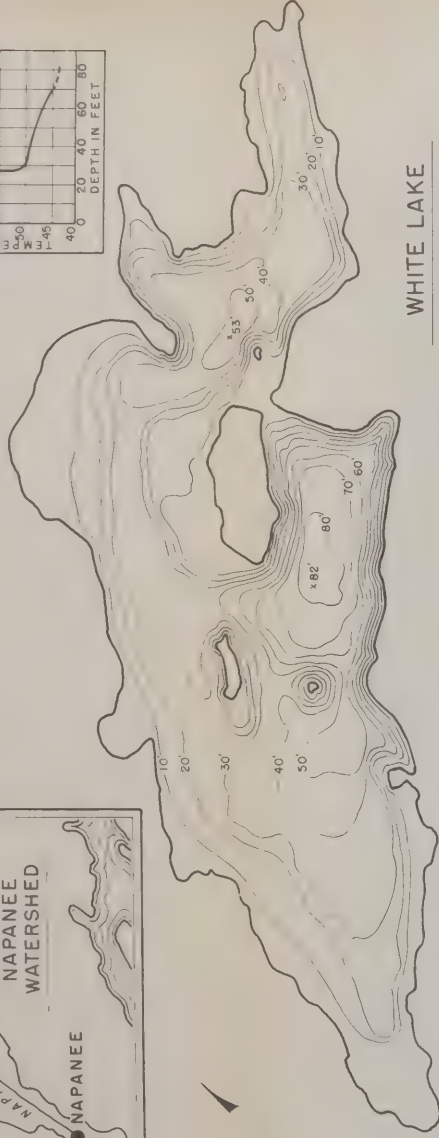


JULY 1950



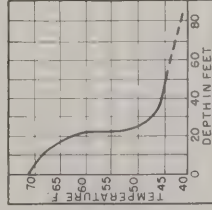
JULY 4, 1950

AIR TEMPERATURE 75°F.  
10.00 A.M.



WHITE LAKE

BEDFORD TWP.

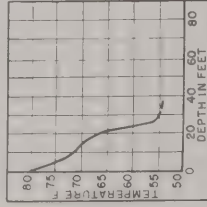


JULY 6, 1950

AIR TEMPERATURE 63°F.  
9.00 A.M.

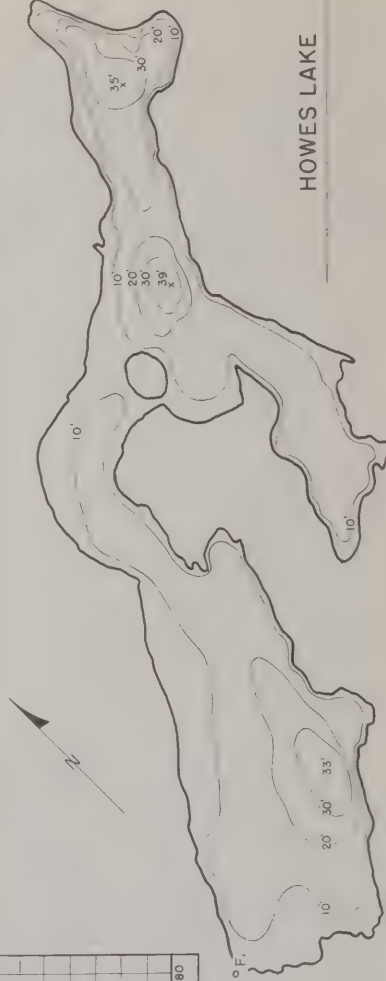


THIRTEEN ISLAND LAKE



JULY 8, 1950

AIR TEMPERATURE 91°F.  
4.30 P.M.



HOWES LAKE



### 3. Permanence of Flow

One might conclude from a rapid examination of a map of the watershed, with the many lakes lying in the courses of the various tributaries, that the flow of the main stream would show relatively little fluctuation, but this is not the case. It is clear that any storage effect caused by the presence of the many lakes in the river and its tributaries is offset by the evaporation effects during the summer. The fact that there are no lakes in the course of the main stream below Petworth in Portland Township, and the great areas having very shallow soil over bedrock in the northern part of the watershed, seem to be the critical factors affecting the river flow in summer. The effect of the Cameron Swamp on the river's flow has not been determined. Whatever the various causes and effects may be, the net result as shown by measurements at the Napanee gauge two miles above the city of Napanee is that there is commonly a period of very low flow in late summer.

The biological examination of the river was made in May and June, 1950, and early in 1956. The difficulty of classifying the types of stream from examination in June may be gauged from the following table, which shows the daily mean flows at the Napanee gauge on various dates in the month of June in 1950 and 1956. During the course of the survey the flow at Napanee varied from 99 c.f.s.\* to 850 c.f.s. At the same gauge flows as low as 1 c.f.s. have been recorded on 15 days during various years since 1920, and there have of course been many periods in late summer when the flow was less than 10 c.f.s.

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\* c.f.s. - cubic feet per second.







DAILY MEAN FLOWS AT VARIOUS DATES IN JUNE 1950 AND 1956  
NAPANEE GAUGE

	June 1	June 5	June 10	June 15	June 20
1950	131	145	164	131	99
1956	686	858	675	440	280

On the accompanying map, "Biological Conditions of Streams", the permanence of flow is shown, so far as it could be deduced from the presence or absence of fish and indicator species, and from local reports. However, many of the smaller streams are marked as "Not examined".

4. Temperature Conditions

The summer temperature conditions which can be expected to affect the distribution of fish in most years are also shown on the accompanying map. Of all those streams examined only a single one was found to be good brook trout water. Adult brook trout should thrive best in the lower part of the section lettered COLD. Usually separate sections with intermediate temperatures, to which brown trout can adapt themselves, are shown on these maps, but no water of this type was noted during the present survey.

Almost all of the streams appeared to consist of the overflow from lakes or marshes, and accordingly all of the water examined, apart from the one trout stream noted, is classified as warm (with maximum over 75°F. in summer) and suitable only for rock bass, smallmouth bass and associates.

5. Fish Distribution

The following 36 species of fish were collected in the waters of the Napanee Watershed during the survey. Those species marked "Lake" were found only in the lakes. The remainder were found in the rivers or in both rivers and lakes.



# LIST OF FISHES OF THE NAPANEE WATERSHED

Based on the 1950 and 1956 collections

<u>Common Name</u>	<u>Scientific Name</u>
*Longnose gar	<u>Lepisosteus osseus</u>
Alewife	<u>Alosa pseudoharengus</u>
*Brown trout	<u>Salmo trutta</u>
*Brook trout	<u>Salvelinus fontinalis</u>
*Shallowwater cisco	<u>Leucichthys artedii</u> (Lake)
White sucker	<u>Catostomus commersoni</u>
Golden shiner	<u>Notemigonus crysoleucas</u>
*Creek chub	<u>Semotilus atromaculatus</u>
Fallfish	<u>Semotilus corporalis</u>
Northern pearl dace	<u>Margariscus margarita nachtriebi</u>
Northern redbelly dace	<u>Chrosomus eos</u>
Finescale dace	<u>Pfritille neogaea</u>
Longnose dace	<u>Rhinichthys cataractae</u>
Rosyface shiner	<u>Notropis rubellus</u>
Common shiner	<u>Notropis cornutus</u>
Blackchin shiner	<u>Notropis heterodon</u>
Blacknose shiner	<u>Notropis heterolepis</u>
Bluntnose minnow	<u>Hyborhynchus notatus</u>
Fathead minnow	<u>Pimephales promelas</u>
*Brown bullhead	<u>Ameiurus nebulosus</u>
*Yellow bullhead	<u>Ameiurus natalis</u>
Central mudminnow	<u>Umbra limi</u>
*Northern pike	<u>Esox lucius</u>
*American eel	<u>Anguilla rostrata</u>
Banded killifish	<u>Fundulus diaphanus</u>
† *Burbot	<u>Lota lota</u>
*Smallmouth bass	<u>Micropterus dolomieu</u>
*Largemouth bass	<u>Micropterus salmoides</u> (Lake)
*Pumpkinseed	<u>Lepomis gibbosus</u>
*Bluegill	<u>Lepomis macrochirus</u>
*Rock bass	<u>Ambloplites rupestris</u>
†† *Yellow walleye	<u>Stizostedion vitreum vitreum</u> (Lake)
*Yellow perch	<u>Perca flavescens</u>
Logperch	<u>Percina caprodes</u>
Iowa darter	<u>Etheostoma exile</u>
Brook stickleback	<u>Eucalia inconstans</u>

\* Species of particular interest to anglers.

† Locally known as the ling.

†† Locally known as the pickerel.

The arrangement and terminology are those approved by W. B. Scott, Curator of Ichthyology and Herpetology, Royal Ontario Museum, Toronto, as of June 1957.

Further collecting or angling would of course increase the known range of some of the species, and there must also be several additional species present.

The one trout stream examined had many young trout in it in 1956. One 14-inch trout was collected and returned.

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January 1, 1917

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The excessive flow in the streams during the surveys made the collection of fish a difficult process, and probably accounted for the fact that some species which are certainly common were actually collected at few stations. Creek chub, for instance, were collected at only 3 stations, and carp at none. The longnose gar and the alewife were found at Napanee only. The species which appeared most commonly in the collections were the bluegill and the bluntnose minnow (at 18 stations each), the pumpkinseed (at 13 stations), the common shiner (at 14 stations), the brown bullhead and yellow perch (at 10 stations each). So far as the streams are concerned, largemouth bass were found only at 1 station and smallmouth bass at 4. Two small fry of the burbot were found in a part of the river at the east end of the Cameron Swamp. The nearest deep lakes from which the adults may have moved to spawn are Howes Lake and Silver Lake.

An accompanying table shows the distribution of some of the fish species (of interest to anglers) which were taken in gill nets or trap nets in 8 of the lakes. Apart from Mud Lake and Varty Lake, both of which are very shallow and lie south of the edge of the Precambrian Shield, and perhaps Fourth Depot Lake, any of the species in the table may be present in any of the lakes examined. Brown trout were caught only in Howes Lake during the survey. Below Strathcona very few live fish were encountered.

## 6. Pollution and Fish Life

There are several points at which the Napanee River is polluted - by debris from grist mills, by septic organic wastes and by the deposition of sawdust, which tends to render the river bottom sterile and to reduce the bottom fauna; but none of these effects was found to be of much importance compared with the pollution from Strathcona.

There are two chief problems caused by the mill effluent. One is oxygen depletion, which is almost inevitable with the effluent of a paper-making plant when most



LIST OF 15 FISH SPECIES OF INTEREST TO ANGLERS, AND THE  
LAKES IN WHICH THEY WERE COLLECTED DURING THE 1950 SURVEY

	Varty Lake	1st Depot Lake	2nd Depot Lake	4th Depot Lake	Howes Lake	13 Island Lake	Silver Lake	White Lake
Shallow- water cisco			x					x
Brown trout					x			
White sucker	x		x	x		x	x	x
Yellow bullhead	x				x		x	x
Brown bullhead		x		x	x	x		x
Northern pike	x	x	x	x	x	x	x	
Yellow perch	x		x	x	x	x		x
Yellow walleye.*				x	x			
Largemouth bass	x				x	x	x	x
Smallmouth bass					x	x		x
Rock bass	x	x	x	x	x	x	x	x
Bluegill		x	x	x	x	x	x	
Pumpkinseed		x	x	x	x	x	x	
Burbot †								x

\* This is the species commonly known as "pickerel" in Ontario and as "walleyed pike" in the United States,

† This species is commonly called the "ling".

The names of these species follow those of "Freshwater Fishes of Eastern Canada" by W. B. Scott, Royal Ontario Museum of Zoology and Palaeontology, published by University of Toronto Press, 1954.



of the stream is used for operating the plant. Much of the material used is old paper. The second problem is phenol control. Since tests\* have repeatedly shown the presence of phenol, and there is apparently no phenol used in the plant operations, it is considered probable that phenol is liberated from certain of the glues in the old papers, notably those containing resorcynol, a benzene derivative, like phenol. Phenol affects the river both in giving the water a carbolic taste and also in giving a phenolic flavour detectable in fish which have been forced to live in water that has more than a trace of phenol in it. The effects of the phenol and the shortage of oxygen were noted in the river well below Napanee. The following concentrations of phenol have been reported to be lethal or damaging to fish:

<u>Concentration</u> <u>in p.p.m.†</u>	<u>Fish</u>
** 9-10	Trout
** 12	Perch
** 17	Minnows

According to Niegowski†† the biologically safe concentration of phenol with respect to mayfly larvae (a useful fish food) is reported as 2.7 p.p.m. Concentrations as high as 18 p.p.m. of what appeared from the indicator reagents to be phenol have been recorded in the river below the mill. For the prevention of tastes in water it has been recommended that phenol concentrations should not exceed 0.002 p.p.m. after initial dilution in streams.

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\* Tests made by the Ontario Department of Health and the Ontario Water Resources Commission.

† p.p.m. = parts per million.

\*\* Wuhrmann, K., and Woker, H. Contributions to the Toxicology of Fish. V. The Toxicity of Phenol for Different Kinds of Fish. Water Pollution Abs. 25, No. 3, 71 (1952).

†† Niegowski, S. J. Destruction of Phenols by Oxidation with Ozone. Industrial and Engineering Chemistry, 45, 632 (1953).



Since it is well established that in periods of low flow virtually the whole of the water of the river passes through the mill, it was considered a useful procedure to carry out a test of the effect of the effluent on the fish of the river, for comparison with conditions after the planned Second Depot Lake Dam is in operation. For this purpose a simplified type of a test originally made by Doudoroff\* was used. Because the river was at a high flow when the tests were made, samples of the actual effluent were taken and diluted with river water from above the mill in four different concentrations. Fish of two species common in the river above the mill were used in the tests. These were the pumpkinseed (Lepomis gibbosus) and the bluntnose minnow (Hyborhynchus notatus). It was not found possible to pass a stream of water past the fish and they were therefore tested in tanks. It is of course possible that there may have been oxygen deficiencies in the experimental aquaria greater than those in the stream itself. Care was therefore taken to use amounts of water much greater than those which usually are considered necessary for survival of the fish used and to renew the supply regularly. Thirty-five minnows and 15 "pumpkinseeds" were used in these tests. Water temperatures were kept at approximately the temperatures of the river.

The median tolerance limit, i.e. the concentration which is lethal to 50 per cent of the test animals, was found to be close to a concentration of 25 per cent effluent for both species. It was found necessary to discontinue the tests on most of the fish after 96 hours, although the wastes might have had later effects on some of the surviving fish.

It was certainly evident that these fish could not live in the summer low flow below the effluent.

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\* Doudoroff, P., et.al., "Bioassay methods for the evaluation of acute toxicity of industrial wastes to fish". Sewage and Industrial Wastes Vol. 23, No. 11.



Debris is dumped by a roadside in spite of signs prohibiting this practice. The smell is extremely offensive. This "dump" is 1½ miles south-west of Carmanville.



The Napanee River at Strathcona, showing the condition before the Peterson type of fibre extractor was installed at the paper mill. Note the murky white water in the left half of the stream.



The dumping of debris at a paper making plant along the edge of a stream. This practice should be prohibited.



A view showing the vegetation in the centre of Varty Lake. The lake is nowhere more than six feet deep.





The following table shows the apparent effect on the individual fish of the different concentrations of the mill effluent in 1956.

	% Concentration of Effluent				
	100	75	50	25	0 (River water above the mill effluent)
Time to death to nearest 12-hour period	0	0	12	36	24
	0	0	12	36	96
	0	0	12	60	s.
	12.	0	12	60	s.
	12.	12.	24.	s.	s.
	12.	12.	24.	s.	s
	12	12.	24.	s.	s
	12	12	24	s	s
	24	12	24	s	s
	24	12	36	s	s

s = survived to end of test (120 hours).

Figures followed by a dot (.) were *Lepomis* sp.  
All others were *Hyborhynchus notatus*.

It is admitted that the sample is extremely small (50 fish), and the method of test is open to some criticism. There is, however, no doubt of a regular trend towards increased lethal effect with increasing concentrations of the wastes.

It is entirely probable that the concentrations of toxic compounds are much greater than those which were found in the samples of the effluent tested, when an occasional poisonous slug is admitted to the river. Investigations now (May 1957) being carried out by Doudoroff and others tend to show that the bottom fauna, which are used by fish as food, are affected by even lesser concentrations of paper mill wastes than are the fish themselves. For any hope of satisfactory



fish life in the river it is therefore essential that the wastes be very efficiently treated and that virtually no phenol be allowed into the river.

It should be fully understood by all those interested in improving the production of fish and wildlife that the construction of the Second Depot Lake Dam is being undertaken primarily to give an adequate supply of water for drinking and other municipal use, and that any benefits to fish and wildlife are therefore secondary.









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Napanee Valley  
Conservation Report  
1957

# NAPANEE RIVER WATERSHED

SHOWING  
AREAS RECOMMENDED  
FOR  
AUTHORITY FOREST  
AND  
EXISTING WOODLAND

ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT  
CONSERVATION BRANCH



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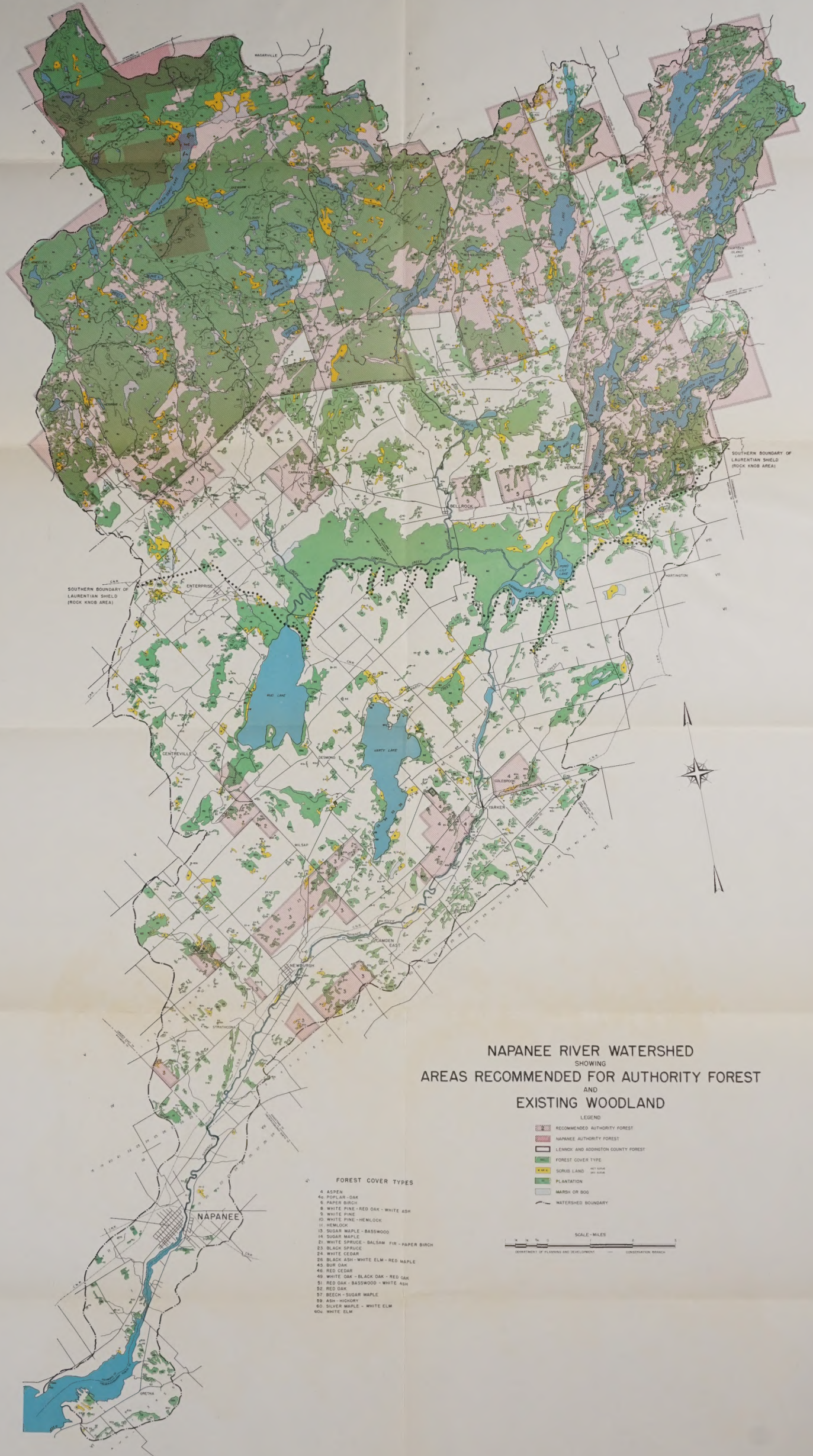
Napanee Valley  
Conservation report  
1957.

# NAPANEE WATERSHED

LAND USE SURVEY

RECOMMENDED  
LAND USE  
ACCORDING TO  
USE CAPABILITY

ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT  
CONSERVATION BRANCH



NAPANEE RIVER WATERSHED  
SHOWING  
AREAS RECOMMENDED FOR AUTHORITY FOREST  
AND  
EXISTING WOODLAND

LEGEND

- RECOMMENDED AUTHORITY FOREST
- NAPANEE AUTHORITY FOREST
- LEWIS AND KIDINGTON COUNTY FOREST
- FOREST COVER TYPE
- SCIRUS LAND
- PLANTATION
- MARSH OR BOG
- WATERSHED BOUNDARY

FOREST COVER TYPES

- 4 ASPEN
- 42 POPLAR - OAK
- 6 PAPER BIRCH
- 8 WHITE PINE - RED OAK - WHITE ASH
- 9 WHITE PINE
- 10 WHITE PINE - HEMLOCK
- 11 HEMLOCK
- 13 SUGAR MAPLE - BASSWOOD
- 14 SUGAR MAPLE
- 21 WHITE SPRUCE - BALSAM FIR - PAPER BIRCH
- 23 BLACK SPRUCE
- 24 WHITE CEDAR
- 28 BLACK ASH - WHITE ELM - RED MAPLE
- 40 BUR OAK
- 45 RED CEDAR
- 49 WHITE OAK - BLACK OAK - RED OAK
- 51 RED OAK - BASSWOOD - WHITE ASH
- 52 RED OAK
- 57 BEECH - SUGAR MAPLE
- 58 ASH - HICKORY
- 60 SILVER MAPLE - WHITE ELM
- 604 WHITE ELM

SCALE - MILES

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